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A COMPUTER CODE FOR THE SOLUTION OF THE EQUATIONS GOVERNING A LAMINAR, PREMIXED, ONE-DIMENSIONAL FLAME

Terence P. Coffee

April 1982



US ARMY ARMAMENT RESEARCH AND DEVELOPMENT COMMAN BALLISTIC RESEARCH LABORATORY ABERDEEN PROVING GROUND, MARYLAND

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| successfully using the code are presented. | | | |
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I. INTRODUCTION

We are interested in determining validated sets of elementary chemical reactions for use in predictive combustion models. For this purpose, a simulation of the laminar, premixed, one dimensional, steady state flame has been implemented. This has the advantage of being a relatively simple combustion problem that also yields predicted temperature and species profiles that can be compared with suitable burner experiments.

The basic idealism is of an infinite column of premixed gas. At some point the gas is ignited. A flame front forms and propagates along the column of gas. All effects are assumed to be one-dimensional. Eventually, the flame will reach steady state. A basic characteristic of the solution is the flame speed, the velocity with which the flame front moves with reference to the undisturbed gas mixture. The flame front is marked by steep temperature and chemical species profiles. The above formulation is referred to as an unbounded, or adiabatic flame.

In practice, a flame is usually stabilized on a burner. That is, the flame will propagate to the burner surface. Loss of heat to the burner will stabilize the flame. This creates different boundary conditions.

This report describes a method of numerically solving the equations governing a laminar, premixed, one-dimensional, steady state flame. Both unbounded flames and burner stabilized flames are discussed. To solve such systems, we have modified a standard package for integrating one-dimensional partial differential equations so that it efficiently handles flame equations. The basic procedure is to integrate the equations in time until the steady state solution is reached. Changes have been made in the basic structure of the code, as well as adding a number of subroutines. The program has been implemented for the ozone flame and the $\rm H_2-O_2-N_2$ flame.

Section II describes the partial differential equations governing the flames. In Section III, the basic code used to solve the equations is introduced. Section IV describes the modifications made in the code, and Section V the additional subroutines added to the program. Section VI discusses the changes in the equations and the code necessary to model burner stabilized flames. Section VII reports some of the numerical considerations in successfully using the code. Finally, the Appendix gives a complete listing of the code, plus the output for a run modeling a typical $\rm H_2\text{--}O_2\text{--}N_2$ flame.

II. THE UNBOUNDED FLAME EQUATIONS

The equations for a multicomponent reacting ideal gas mixture can be found in the literature. $^{1-4}$ We are interested in the equations that describe a one-dimensional, laminar, premixed flame that propagates in an unbounded medium. The effects of radiation, viscosity and body forces are ignored. The momentum equation

$$\hat{\rho} = \frac{\partial \hat{\mathbf{v}}}{\partial \hat{\mathbf{t}}} = -\hat{\rho} \hat{\mathbf{v}} = \frac{\partial \hat{\mathbf{v}}}{\partial \hat{\mathbf{x}}} - \frac{\partial \hat{\mathbf{p}}}{\partial \hat{\mathbf{x}}}$$

can be eliminated. Here \hat{v} is the fluid velocity, $\hat{\rho}$ is the density, and \hat{p} is the pressure. The independent variables are time \hat{t} (sec) and distance \hat{x} (cm). For flames, the fluid velocity is much less than the speed of sound, that is, $\hat{v}^2 << \hat{p}/\hat{\rho}$. For steady state flow, this implies that the pressure gradient is negligibly small. So the pressure is assumed to be constant.

The pertinent equations are then, overall continuity.

$$\frac{\partial \hat{\rho}}{\partial \hat{t}} = -\frac{\partial \left(\hat{\rho}\hat{\mathbf{v}}\right)}{\partial \hat{\mathbf{x}}} . \tag{1}$$

That is, any change in density with respect to time is due to the overall convection of the mixture, which equals the gradient of the total mass flux ρv .

Continuity of species:

$$\hat{\rho} \frac{\partial \hat{Y}_k}{\partial \hat{t}} = -\hat{\rho} \hat{v} \frac{\partial \hat{Y}_k}{\partial \hat{x}} - \frac{\partial}{\partial \hat{x}} (\hat{\rho} \hat{Y}_k \hat{V}_k) + \hat{R}_k M_k, \quad k = 1, 2, ... N$$
 (2)

¹F. A. Williams, <u>Combustion Theory</u>, Addison-Wesley, Reading, MA, Chapter 1. 1965.

²R. B. Bird, W. E. Stewart and E. N. Lightfoot, <u>Transport Phenomena</u>, John Wiley and Sons, NY, Chapter 18, 1960.

³R. M. Fristram and A. A. Westenberg, Flame Structure, McGraw-Hill, NY, Chapter V-1, 1965

⁴J.O. Hirshfelder, C. F. Curtiss and R. B. Bird, <u>Molecular Theory of Gases and Liquids</u>, 2nd Printing corrected, with notes, John Wiley and Sons, NY, Chapter 11.1, 1964.

where \hat{Y}_k is the mass fraction of the k^{th} species, \hat{V}_k is its diffusion velocity, M_k is its molecular weight, and \hat{R}_k is the rate at which the species is produced or consumed by the chemical reactions. So changes in the concentration of the k^{th} species can be due to the convection of the species, the diffusion of the species in the mixture, or the production or consumption of the species by chemistry. The term $\hat{\rho}\hat{Y}_k\hat{V}_k$ is the mass flux of the k^{th} species (relative to \hat{v}). Note that the total mass flux for the k^{th} species is $\hat{\rho}(\hat{v}+\hat{V}_k)$ \hat{Y}_k .

Conservation of Energy.

$$\hat{\rho} \hat{c}_{p} \frac{\partial \hat{T}}{\partial \hat{c}} = -\hat{\rho} \hat{v} \hat{c}_{p} \frac{\partial \hat{T}}{\partial \hat{x}} + \frac{\partial}{\partial \hat{x}} \left(\hat{\lambda} \frac{\partial \hat{T}}{\partial \hat{x}} \right) - \sum_{k=1}^{N} \hat{R}_{k}^{M} k^{\hat{h}} k$$

$$-\hat{\rho} \sum_{k=1}^{N} \hat{c}_{pk} \hat{Y}_{k} \hat{V}_{k} \frac{\partial \hat{T}}{\partial \hat{x}}$$
(3)

where \hat{T} is the temperature, \hat{c}_{pk} is the specific heat of the k^{th} species, \hat{c}_p is the specific heat of the mixture, $\hat{\lambda}$ is the thermal conductivity of the mixture, and \hat{h}_k is the specific enthalpy of the k^{th} species. So changes in the temperature can be due to the convection of heat, the conduction of heat, the production or consumption of energy by the chemical reactions, and a small amount due to the diffusion of species with different specific heats. We have not written a negligibly small term due to the species gradients (Dufour effect).

The thermal equation of state is given by the ideal gas law

$$\hat{p} = \hat{\rho} R \hat{T} \sum_{k=1}^{N} \hat{Y}_{k}/M_{k}, \qquad (4)$$

where R is the gas constant. The caloric equation of state is

$$\hat{h}_{k} = \hat{h}_{k}^{o} + \int_{\hat{T}_{o}}^{\hat{T}} \hat{c}_{pk} d\hat{T},$$
(5)

where \hat{h}_{i}^{O} is the specific enthalpy of the k^{th} species at some reference temperature \hat{T}_{O} . The specific heat of the mixture is given by

$$\hat{c}_{p} = \sum_{k=1}^{N} \hat{c}_{pk} \hat{Y}_{k}. \tag{6}$$

From conservation of mass we have the relation

$$\sum_{k=1}^{N} \hat{Y}_k = 1 \tag{7}$$

and

$$\sum_{k=1}^{N} \hat{i}_k \hat{V}_k = 0.$$
 (8)

The boundary conditions are the following. For $x = -\infty$.

$$\hat{T} = \hat{T}_{U}$$
 and $\hat{Y}_{k} = \hat{Y}_{kU}$, (k=1,2,...N),
(9)

where \hat{T}_U is the temperature and the \hat{Y}_{kU} are the mass fractions of the original, undisturbed mixture. For $x = \infty$

$$\hat{T} = \hat{T}_{B} \text{ and } \hat{Y}_{k} = \hat{Y}_{kB}, k=1,2,...N$$
 (10)

where \hat{T}_B is the temperature and \hat{Y}_{kB} are the mass fractions of the burned mixture. \hat{T}_B is called the adiabatic temperature. Since we are assuming no heat loss to the surroundings, T_B and Y_{kB} depend only on the chemistry, and can be calculated in advance.

In practice, the integration will be over a finite interval (\hat{x}_L, \hat{x}_R) , where the flame front will be located roughly in the center of the interval. The boundary conditions (9) will be applied to \hat{x}_L . However, the conditions (10) are not convenient. After the flame front, there is a long recombination period before the mixture reaches adiabatic conditions. Choosing the interval of integration long enough to cover the entire recombination zone would be computationally expensive. So normally the flame will be cut off before it reaches adiabatic conditions,

and the weaker boundary conditions

$$\frac{\partial \hat{T}}{\partial \hat{x}} = \frac{\partial^{2} k}{\partial \hat{x}} = 0, \quad k=1,2,...N , \qquad (11)$$

will be applied at \hat{x}_R .

At this stage the partial differential Eq. (1) for the density $\hat{\rho}$ can be eliminated by introducing a new coordinate $\hat{\psi}$ such that

$$\hat{\psi}(\hat{x},\hat{t}) = \int_{\hat{x}_L}^{\hat{x}} \hat{\rho}(\hat{x}',\hat{t}) dx'. \qquad (12)$$

Then $\frac{\partial \hat{\psi}}{\partial \hat{x}} = \hat{\rho}$ and $\frac{\partial \hat{\psi}}{\partial \hat{t}} = -\hat{\rho}\hat{v} + \hat{m}_{o}(\hat{t})$, where $m_{o}(\hat{t}) = \hat{\rho}\hat{v}|_{x=0}$. With this

notation Eqs. (2) and (3) become

and

$$\frac{\partial \hat{T}}{\partial \hat{t}} = -\tilde{m}_{0} \frac{\partial \hat{T}}{\partial \hat{\psi}} + \frac{1}{\tilde{c}_{p}} \left\{ \frac{\partial}{\partial \hat{\psi}} \left(\tilde{\rho} \, \tilde{\lambda} \, \frac{\partial T}{\partial \hat{\psi}} \right) \right\}$$

$$-\frac{N}{\Sigma} \tilde{R}_{k} M_{k} \tilde{h}_{k} / \tilde{\rho} - \frac{N}{\Sigma} \tilde{c}_{pk} \tilde{Y}_{k} \tilde{V}_{k} \frac{\partial \tilde{T}}{\partial \hat{\psi}} \right\} , \qquad (14)$$

where the tilde variables are functions of $\hat{t} = \hat{t}$ (sec) and $\hat{\psi}$ (gm/cm²).

For numerical convenience, dimensionless forms of Eqs. (13) and (14) are integrated. That is, we will define $T=\tilde{T}/T_{\infty},\ t=\tilde{t}/t_{\infty}$ and $\psi=\tilde{\psi}/\psi_{\infty},$ where t_{∞} and ψ_{∞} are chosen so as to obtain reasonable time and space scales for a given flame, and T_{∞} is chosen so that T is the same order of magnitude as the larger Y_k 's . Then the equations are

$$\frac{\partial Y_k}{\partial t} = -\frac{t_{\infty}}{\psi_{\infty}} m_0 \frac{\partial Y_k}{\partial \psi} - \frac{t_{\infty}}{\psi_{\infty}} \frac{\partial}{\partial \psi} (\rho Y_k V_k) + t_{\infty} R_k M_k/\rho , \quad (15)$$

and

$$\frac{\partial T}{\partial t} = -\frac{t_{\infty}}{\psi_{\infty}} m_{0} \frac{\partial T}{\partial \psi} + \frac{t_{\infty}}{c_{p}} \left\{ \frac{1}{\psi_{\infty}^{2}} \frac{\partial}{\partial \psi} \left(\rho \lambda \frac{\partial T}{\partial \psi} \right) \right\}$$

$$- \sum_{k=1}^{N} R_{k} M_{k} h_{k} / (\rho T_{\infty}) - \frac{1}{\psi_{\infty}} \sum_{k=1}^{N} c_{pk} Y_{k} V_{k} \frac{\partial T}{\partial \psi} ,$$

$$k=1$$
(16)

where the variables are functions of t and ψ . The boundary conditions are

$$T = T_{U}$$
 , $Y_{k} = Y_{k | U}$, $k = 1, 2... N$ (17)

at $\psi = \psi_L$ and

$$\frac{\partial T}{\partial \psi} = \frac{\partial Y_k}{\partial \psi} = 0 , \quad k = 1, 2 ... N$$
 (18)

at $\psi = \psi_R$

The integration can start from any initial profiles, as long as there is enough energy available to begin the combustion. As shown in Section V, the mass flux m through the origin is modified as the integration proceeds so as to keep the flame front in the center of the interval of integration $(\psi_L,\,\psi_R)$. The integration proceeds until m approaches a constant, and the terms $\frac{\partial Y}{\partial t}$ and $\frac{\partial T}{\partial t}$ approach zero. The equation for species N is not integrated; Y_N is found from the relation (7).

The burning velocity, S_{ν} , can be calculated at steady state. From the continuity equation $\vartheta(\rho\nu)'/\vartheta\psi=0$, or $\rho\nu$ is constant with respect to ψ . Then we can take any of the equations (15) and integrate over any interval (a,b) to obtain

$$\rho v_{k} [Y_{k}(b) - Y_{k}(a)] = \psi_{\infty} \int_{a}^{b} \rho^{-1} R_{k}^{M} k^{d \psi} - \rho Y_{k} V_{k | a}^{b}.$$
 (19)

Then

$$V_{k}(-\infty) = \frac{\psi_{\infty} \int_{a}^{b} \rho^{-1} R_{k} M_{k} d\psi - \rho Y_{k} V_{k} | a^{b}}{\rho (-\infty) [Y_{k}(b) - Y_{k}(a)]}. \qquad (20)$$

At steady state, all of the v_k are equal. Since in the present coordinate system the flame does not move, v_k (- ∞) is the speed at which the unburned gas is approaching the flame. Conversely, $S_v = v_k$ (- ∞) is the speed at which the flame is propagating into the unburned mixture.

The parameters of the equations (15) and (16) are the specific heats c_{nk} , the specific enthalpies h_k , the chemistry production terms R_{ν} , and the diffusion velocities V_{ν} for each species, plus the thermal conductivity λ of the mixture. The \boldsymbol{c}_{pk} and \boldsymbol{h}_k are functions only of the temperature, and can be evaluated very accurately using sixth degree polynomial fits⁵. The chemistry is generally the least well known of the input data. We need to know which species are involved, which reactions can occur, and the rate constant for each reaction. The rate constants k_i will be of the form a $\tilde{T}^{\ b}$ exp (c/ \tilde{T}), where either b or c can be zero. We can then find the rate r, for each reaction by multiplying the rate constant times the concentrations of the reactants (concentrations of the k^{th} species = $\rho Y_k / M_k$). Each R_k is then found by adding the rates of the reactions in which the kth species is a reactant. The transport parameters λ and V_k are in general very complicated functions of temperature and species concentrations. Because of the numerical complexity, various approximations to these quantities have been used. We have the capability to run the code with a number of different levels of approximation. This is discussed in detail in another paper.

⁵S. Gordon and B. J. McBride, "Computer Program for Calculation of Complex Chemical Equilibrium Compositions, Rocket Performance, Incident and Reflected Shocks, and Chapman-Jouguet Detonations", NASA-SP-273, 1971, (1976 program version).

⁶T. P. Coffee and J. M. Heimerl, "Transport Algorithms for Premixed, Laminar, Steady-State Flames", to be published in Combustion and Flame.

For future reference, we will discuss here the simplest transport algorithm used in the code. First assume that Ficks law,

$$\hat{Y}_{k} \hat{V}_{k} = -\hat{D}_{k m} \frac{\partial \hat{Y}_{k}}{\partial \hat{x}}$$
 (21)

is valid. This is only strictly true for a binary mixture where thermal diffusion is negligible. $\hat{D}_{k\ m}$ is a multicomponent diffusion coefficient. Equation (21) can be written as

$$\rho Y_{k} V_{k} = -\frac{\rho^{2} D_{k m}}{\psi_{\infty}} \frac{\partial^{Y}_{k}}{\partial \psi} . \tag{22}$$

As a first approximation, we can take ρ^2 D_{k m} and ρ λ to be constant. Also, we can assume that c_p = c_{p k}, k=1,2,...N. Here c_p must be chosen so as to obtain the proper adiabatic temperature T_B. The procedure for choosing these constants and the justification of this approximation is given in reference 6. This level of approximation is reasonably accurate, if the constants are properly chosen.

Equations (15) and (16) now become

$$\frac{\partial Y_{k}}{\partial t} = -\frac{t_{\infty}}{\psi_{\infty}} m_{0} \frac{\partial Y_{k}}{\partial \psi} + \frac{t_{\infty}}{\psi_{\infty}} \rho^{2} D_{km} \frac{\partial Y_{k}}{\partial \psi^{2}} + t_{\infty} R_{k} M_{k} / \rho \qquad (23)$$

and

$$\frac{\partial I}{\partial t} = -\frac{t_{\infty}}{\psi_{\infty}} \quad {}^{m}o \quad \frac{\partial T}{\partial \psi} + \frac{t_{\infty}}{c_{p}} \left\{ \frac{\rho \lambda}{\psi_{m}^{2}} - \frac{\partial^{2} T}{\partial \psi^{2}} - \frac{N}{k^{\Sigma}_{1}} - \frac{R_{k}^{M_{k}} h_{k}}{\rho T_{\infty}} \right\}. \tag{24}$$

Equation (5) now simplifies to

$$h_k = h_k^0 + c_p(T - T_0)$$
, (25)

so the required input parameters for this level of approximation are the constants $\rho^2 D_k^{}_{m}$, ρ λ , c_p , h_k^{o} and the functions $R_k^{}(T$, Y_1 , ..., Y_N^{o}).

III. THE NUMERICAL METHOD - PDECOL

The package PDECOL, developed by Madsen and Sincovec⁷, was used to solve the equations. This package is designed to solve a general system of N nonlinear partial differential equations of at most second order on a finite interval. In our coordinate system the appropriate form is

$$\frac{\partial \vec{u}}{\partial t} = f(t, \psi, \vec{u}, \vec{u}, \vec{u}_{\psi}, \vec{u}_{\psi\psi}), \qquad (26)$$

where

$$\vec{u} = (Y_1, \dots, Y_{N-1}, T)$$

$$\vec{u}_{\psi} = (\frac{\partial Y_1}{\partial \psi}, \dots, \frac{\partial Y_{N-1}}{\partial \psi}, \frac{\partial T}{\partial \psi}),$$

$$\vec{u}_{\psi\psi} = (\frac{\partial^2 Y_1}{\partial \psi^2}, \dots, \frac{\partial^2 Y_{N-1}}{\partial \psi^2}, \frac{\partial^2 T}{\partial \psi^2}).$$
(27)

Fairly general boundary conditions of the form

$$\vec{b} (\vec{u}, \vec{u}_{\psi}) = \vec{Z} (t)$$
 (28)

are allowed, where \vec{b} and \vec{Z} are arbitrary vector valued functions with N components. Each solution component is assumed to be a known function of ψ at the initial time $t=t_0$. That is, $Y_k(t_0,\psi)$, $k=1,2,\ldots N-1$, and T (t_0,ψ) are known functions. The initial conditions must be consistent with the boundary conditions.

The spatial discretization is accomplished by finite element collocation methods based on B-splines 8 . The user must supply a set of

N. K. Madsen and R. F. Sincovec, "PDECOL: General Collocation Software for Partial Differential Equations", Preprint UCRL-78263 (Rev 1), Lawrence Livermore Laboratory, (1977).

 $^{^8}$ C. de Boor, "Package for Calculating with B-Splines", Siam, J. Numer. Anal. $\underline{14}$, 441-472, (1977).

NB breakpoints, that is, a set of strictly increasing locations where the polynomials are joined. He must also supply the order KORD of the splines and the number of continuity conditions, NCC, to be applied at the breakpoints. That is, if NCC=1, the approximating function is continuous; if NCC=2, it is continuous and smooth; and so on. PDECOL then generates a set of NC = KORD(NB-1) - NCC(NB-2) basis functions and collocation points. The basis functions $B_{\hat{1}}(\psi)$ are piecewise polynomials of order KORD - 1. The basic assumption is that the solution can be written in the form

$$u_k = \sum_{i=1}^{N} c_k^{(i)}(t) B_i(\psi), k=1,...N,$$
 (29)

where the basis functions $B_i(\psi)$ span the solution space for any fixed t to within a small error tolerance. The time dependent coefficients $c_k(i)$ are determined uniquely by requiring that the expansions above satisfy the given boundary conditions and that they satisfy the partial differential equations exactly at the (N-2) interior (collocation) points. Since by definition a B-spline is zero except over a small interval, at any collocation point no more than KORD of the B-splines are non-zero. So the system of ODE's for the coefficients $c_k(i)$ will not be fully coupled.

The boundary conditions (28) must also be changed into ordinary differential equations. This can be done by taking the derivative with respect to time, which results in

$$\sum_{j=1}^{N} \left[\frac{\partial b_k}{\partial u_j} \frac{\partial u_j}{\partial t} + \frac{\partial b_k}{\partial u_{j\psi}} \frac{\partial u_{j\psi}}{\partial t} \right] = \frac{dZ_k}{dt}, \quad k=1,2...N.$$
 (30)

When equation (29) is substituted into equation (30), a set of ODE's in the $c_{\rm k}({\rm i})$ results.

Unlike a finite difference code, the program can be run with no boundary condition at either the left or the right boundary. The program simply collocates at the boundary, using the same procedure as for the interior points. It must be, of course, the user's responsibility to define a mathematically meaningful PDE problem.

This system of ODE's is integrated in time, using a variant of the Gear stiff integrator⁹. This is a fully implicit, predictor-corrector method. The required banded Jacobian is generated internally by the program. Once the integrator has reached a desired output time, the values of Y_k and T can be obtained for any ψ by substituting into the expansions (29). The accuracy of the time integration is determined by a user supplied error tolerance ε .

For the actual integration, the code requires the values of the basis functions and the first two space derivatives only at the collocation points. Since computing these values is complicated, this is done once at the beginning of the program and the values are saved.

In general, a user must supply a main program and three subroutines. The program MAIN sets the values of the required parameters, calls the integrator, and writes any desired output. The subroutine UINIT gives the initial conditions. Given a collocation point ψ , the subroutine must return the vector \vec{u} (t, ψ). The subroutine F evaluates the function \vec{f} given by Eq. (26). Given t, ψ , u, u_{ψ} , and $u_{\psi\psi}$, the routine must return the vector $\partial u/\partial t$. The program automatically converts this to the corresponding set of ODE's involving the $c_k^{(1)}$. The subroutine BNDRY specifies the boundary conditions. That is, given t, ψ , \vec{u} , and \vec{u}_{ψ} , the subroutine returns the quantities $\partial b_k/\partial u_j$, $\partial b_k/\partial u_j$, $\partial Z_k/\partial t$, j, $k=1,2\dots$ N, for both ψ_L and ψ_R .

IV. MODIFICATIONS OF PDECOL

The time integration is controlled by a user supplied error tolerance ϵ . Single step error estimates divided by CMAX $_k$ (i) will be kept less than ϵ in the root-mean-square norm. In PDECOL, CMAX $_k$

is initially set to the maximum of $|c_k^{(i)}|$ and 1.0. Thereafter, CMAX_k⁽ⁱ⁾ is the largest value of $c_k^{(i)}$ seen so far, or the initial CMAX_k⁽ⁱ⁾ if that is larger. However, this error criterion does not produce the desired accuracy for flame simulations, because radical species with small concentrations will control the flame, and must be computed accurately. But mass fractions much smaller than 1.0 will not be computed accurately using the original PDECOL criterion. An alternate criterion is the purely relative error criterion, that is, CMAX_k⁽ⁱ⁾ = $|c_k^{(i)}|$. This criterion is also unacceptable because some species

at some locations will approach zero, and excess computation will result

A. C. Hindmarsh, "Preliminary Documentation of GEARIB: Solution of Implicit Systems of Ordinary Differential Equations with Banded Jacobian", Rep. UCID-30130, Lawrence Livermore Laboratory, (1976).

in accurately computing these negligible concentrations. Consequently a semi-relative error control is used. CMAX $_k^{(i)}$ is chosen as the maximum of $c_k^{(i)}$ and a user supplied parameter SREC. Thus, mass fractions less than SREC will be computed less accurately. We have normally used SREC=10⁻⁶.

The original program PDECOL is fully implicit. That is, it generates a set of $NO = N \times NC$ ordinary differential equations of the form

$$A \frac{d\vec{c}}{dt} = \vec{g}(t, \vec{c}) , \qquad (31)$$

where $c = (c_1^{(1)} \dots c_N^{(1)}, c_1^{(2)} \dots c_N^{(2)} \dots)$. The resulting Jacobian $\partial g/\partial c$ is a banded NO by NO matrix. The band width is 3 X ML+1, where ML = N (KORD - 1) - 1. To advance a time step, the program first computes an explicit predictor for the values of the $c_k^{(i)}$ at the next time step. Then it solves a set of linear algebraic equations involving the Jacobian to correct the values. For a stiff system, such as one involving chemistry, this allows time steps orders of magnitude larger than those of an explicit method. The drawback is the storage and execution time required to work with the Jacobian.

For example, consider a system where KORD = 4, N = 10, and NC = 20. The bandwidth of the Jacobian is 88, and we have a system of 300 ODE's. We then have 26,400 possible non-zero elements in the banded matrix. The amount of storage required also increases rapidly. For instance, if N = 20 instead of 10 the bandwidth will be 178, and we will require 106,800 words to store the Jacobian. Since we want to be able to solve systems at least this large, the storage requirements become almost prohibitive. In addition, solving such large systems of linear algebraic equations is very time consuming.

To avoid this problem, we essentially uncouple the partial differential equations and solve them successively. The basic procedure is illustrated below. Suppose we are at time t and we want to advance a time step to t_{n+1} . We first integrate the equation for Y_1 , under the assumption that Y_2, \ldots, Y_{N-1} , T are constant at their t_n values. This uncouples the first PDE from the system. Subsequently, we integrate the second PDE for Y_2 , using the new value of Y_1 at t_{n+1} , and the old values for the other variables. Continuing this process, we finally solve for $T(t_{n+1})$, using updated values for all the mass fractions.

In general, this method is restricted to smaller step sizes than a fully implicit method. However, as steady state is approached, all the variables approach constants with respect to time, and the temporal coupling vanishes.

Now consider how this assumption affects the associated system (31) of ODE's. In the Jacobian, we will have

$$\partial g_k^{(i)}/\partial c_k^{(j)} = 0$$
 if $k \neq k$.

That is, changes in the ℓ^{th} PDE will not affect the k^{th} PDE if $k \neq \ell$. So most of the terms in the Jacobian will become zero.

The remaining nonzero elements are not in banded form. However, we can accomplish this by rearranging the vector $\vec{c} = (c_1^{(1)}, c_1^{(2)}, \dots c_1^{(NC)}, c_2^{(NC)}, \dots c_2^{(NC)})$. That is, the coefficients for each PDE are grouped together instead of the coefficients for each collocation point.

The Jacobian matrix can now be decomposed into N smaller NC X NC matrices on the main diagonal. Moreover, the band width of these matrices is only 3XML+1, where ML = KORD - 2. The Jacobian is essentially N separate Jacobians, each for one PDE with NC collocation points.

The savings in storage space is dramatic. For our previous example of KORD = 4, N = 10, and NC = 30, we have 2100 nonzero elements instead of 26,400. If N = 20, we have only 4200 nonzero elements instead of 106,800.

The following procedure is used to actually integrate a time step. The predictor of the predictor-corrector method is used to obtain first estimates for all the $c_k^{(1)}$. Then the corrected $c_1^{(1)}$ are computed, using the first small Jacobian and assuming that the other $c_k^{(1)}$ do not change. Then the corrected values for $c_1^{(1)}$ and the predicted values for $c_k^{(1)}$, k > 2, are used, and the corrected $c_2^{(1)}$ are computed. This process continues through the N PDE's. The estimated error is calculated. If necessary, the above procedure is iterated. It is more efficient to use the predicted values rather than the values at the previous time step. In using the procedure, it is more efficient to integrate the minor species first, since they change most rapidly, then the major species, and finally the temperature.

The above procedure is similar to one developed by Spalding and Stephenson for use in a finite difference ${\sf code}^{10}$.

¹⁰ D.B. Spalding and P.L. Stephenson, "Laminar Flame Propagation in Hydrogen + Bromine Mixtures", Proc. R. Soc. Lond. A. 324, 315-337 (1971).

PDECOL was rewritten to use the successive calculation method. This also means that we must change the user supplied routines F and BNDRY. Because of the rearrangement of the vector \vec{c} , the core integrater will call F first at each collocation point, asking for the values of $\partial Y_1/\partial t$. It will then repeat for each PDE. The routine F is written so as to return only the desired time derivative.

Since the problem can no longer directly handle coupling terms, the boundary conditions (28) must be uncoupled, that is, the boundary conditions must be of the form

$$b_k(u_k, u_{k\psi}) = Z_k(t)$$
 (32)

The rewritten subroutine BNDRY evaluates the quantities $\partial b_k/\partial u_k$, $\partial b_k/\partial u_k$, $\partial z_k/\partial t$, k=1,2...N.

Comparisons of the execution time of the fully implicit method versus the successive calculation method have not been made. However, our main purpose was not to reduce the execution time but to reduce the storage requirements. This iterative procedure accomplishes this goal and simultaneously gives accurate results in reasonable run times.

V. ADDITIONS TO PDECOL

The computer program PDECOL requires a set of user supplied subroutines. We have written a set of subroutines that casts the equations into a computationally efficient form and which generates the required output. These routines are the first seven listed in the appendix; namely MAIN, F, UINIT, FLSP, BNDRY, BKPT, and RT. In addition, several auxiliary programs are mentioned, but without providing a listing. These routines generate sets of input data or actual subroutines that are used frequently, or analyze the output of the flame code.

The code can be run with several different options. We first describe the case of an unbounded flame (NBURN = 0) using the simplest constant transport algorithm (NTRAN = 1). There is no information available about the flame speed or the solution profiles (NSTART = 1). Later in this section we describe restarting the integration (NSTART = 2), and using a more complicated transport algorithm (NTRAN = 2). Burner stabilized flames (NBURN = 1) are discussed in the next section.

Initially, a chemistry scheme must be chosen. In the appendix an H_2 - 0_2 - N_2 system is used, with nine chemical species (H, OH, 0, $H0_2$, $H20_2$, $H200_2$, H2

code. This code writes the subroutine RT that computes the chemistry terms $R_{\rm L}$ $M_{\rm L}/\rho$. The procedure is analogous to that used to write the transport subroutines⁶. This subroutine is attached to the flame code in the job stream and can be used for any problem involving this set of kinetics.

The actual subroutine RT has three main parts. The rate constants are evaluated for the current temperature and stored in the vector RK. Since the code uses a successive calculation method, the subroutine will be called N times at each time step and each collocation point. The rate constants are only recomputed if the temperature has been changed. Otherwise this section is skipped. Each rate constant is multiplied by the concentrations of the appropriate reactants divided by ρ to obtain r_j/ρ . The terms $R_k\ M_k/\rho$ (stored in the vector R) are calculated by adding the rates for the reactions in which Y_k is a product, subtracting the rates for which Y_k is a reactant, and multiplying by M_k .

The choice of a transport algorithm determines the form of the subroutine F. The version given in the appendix is for constant transport. Common statements are used to make the appropriate constants available for all subroutines. The chemistry terms required are found by calling RT.

The initial temperature T_U and mass fractions Y_{kU} of the unburned gas are input quantities. Another auxiliary code determines the adiabatic temperatures T_B and mass fractions Y_{kB} , and the constants $\rho^2 D_{km}$, h_k^0 , $\rho \lambda$, and c_p needed by the constant transport algorithm (see reference 6). This information is saved on a data file and attached to TAPE 11 when the code is run.

The remaining data necessary to run the program is read in on cards (TAPE 5). The pressure p and the normalizing constants t_∞ , ψ_∞ , and T_∞ are specified. The option parameters NSTART, NTRAN, and NBURN are chosen. The numerical parameters required by the code are specified; that is, ψ_L and ψ_R , the final integration time t_{FINAL} , the time integration error control parameters ε and SREC, and a set of breakpoints.

The major difficulty in efficiently solving the flame equations is choosing an appropriate set of breakpoints. These must be close enough that spatial errors are minimized and yet not so dense that one's computer resources are exceeded. The breakpoints should be densest in the flame front, where the gradients are very steep.

The technique in the code is to use a static mesh, with the break-points most closely spaced near the center of the interval of integration. The flame front is then forced to remain near the center of the interval. This is done by adjusting m_0 , the mass flux through the origin. At steady state, the mass flux through the flame is a constant. So m_0 is

iteratively modified to match the steady state mass flow through the flame. This leads to a coordinate system in which the flame front is at rest. The transient behavior can cause the flame front to drift away from the center. This can also be corrected by modifying \mathbf{m}_{O} .

This method requires a procedure for tracking the flame front. To do this the position of a specific temperature $T_{\rm CR}$ is monitored. The code attempts to keep this temperature located at the center of the interval of integration. As a heuristic rule this temperature is defined by

$$T_{cn} = T_{U} + 0.4 (T_{B} - T_{U})$$
 (33)

The average of T_{IJ} and T_{B} is not used. This is because the mixture will not normally reach the adiabatic temperature at the end of the flame front. Rather, there is a radical overshoot, and the recombination of these radicals will very slowly raise the temperature. T_{CR} as defined will usually be close to the center of the flame front. The details of this iterative procedure are discussed in reference 11.

So the breakpoints may be chosen to be densest in the center of the interval of integration. However, it is tedious to have to choose an entire breakpoint sequence for each problem. We have developed a procedure to generate an appropriate type of breakpoint sequence from a small number of parameters. By varying three parameters, a wide variety of breakpoint sequences can be generated.

The user must supply NINT, the number of intervals (NB = NINT+1), NCN, the number of intervals of equal length that will be at the center of the interval, and FC, the ratio between the longest intervals (on the boundaries) and the shortest intervals. Also let L be the total length of the interval of integration, that is, L = ψ_R - ψ_L . The program generates a set of intervals whose lengths increase by a constant factor α , where

$$a = \log^{-1} [2(\log FC)/(NINT-NCN)]$$
 (34)

The common length LC of the NCN center shortest intervals is

$$LC = L/[NCN + 2 \alpha(\alpha^{(NINT-NCN)/2}-1)/(\alpha-1)].$$
 (35)

The procedure can best be seen by example. Suppose we have $\psi_L = 0$,

¹¹ T.P. Coffee and J.M. Heimerl, "A Method for Computing the Flame Speed of a Laminar, Premixed, One Dimensional Flame", BRL Technical Report ARBRL-TR-02212, January 1980.

 $\psi_{\rm p}$ = 10, NINT = 12, NCN = 4, and FC = 6. Then L = 10, α = 1.5651, and LC = .3155. The resulting breakpoint sequence is given in Table 1. Note that the 4 center intervals are of the same length, the length of the intervals then increases by a factor of α , and the two intervals by the boundaries are 6 times as long as the central intervals. So the procedure automatically generates a set of breakpoints that are closest together near the center, with the spacing increasing smoothly toward the boundaries.

Some experimentation is necessary to choose the proper value of the above parameters. However, choosing NINT = 12, NCN = 4, and FC between 4 and 8 has worked in most of the cases we have tried. Normally we experiment using the constant transport algorithm, and then use a more realistic transport subroutine once we have a good breakpoint sequence.

TABLE 1. THE SET OF BREAKPOINTS GENERATED BY L = 10, NINT = 12, NCN = 4 and FC = 6.

| Breakpoints | Interval Lengths |
|-------------|------------------|
| 0.0 | |
| 1.8929 | 1.8929 |
| 7 1024 | 1.2094 |
| 3.1024 | ,7728 |
| 3.8752 | .4937 |
| 4.3689 | |
| 4.6844 | . 3155 |
| 5.0000 | .3155 |
| 5.3155 | .3155 |
| | .3155 |
| 5.6310 | .4937 |
| 6.1247 | .7728 |
| 6.8975 | |
| 8.1069 | 1.2094 |
| 10.0000 | 1.8929 |

The breakpoint sequence is written by the subroutine BKPT. It also generates a larger set of evaluation points by interpolating between the breakpoints. Using Eq. (29), the subroutine VALUES can evaluate the Y_k and T at this larger set of points. This information is useful in generating detailed output, such as graphs, or in performing numerical integrations (see below).

The subroutine UINIT writes the initial profiles, where

$$\psi_{1} = \psi_{L} + 0.24 (\psi_{R} - \psi_{L})$$

$$\psi_{2} = \psi_{L} + 0.64 (\psi_{R} - \psi_{L})$$
(36)

and

$$Y_{k}(t_{o}, \psi) = \begin{cases} Y_{kU}, & \psi_{L} \leq \psi \leq \psi_{1}. \\ Y_{kU} + (Y_{kB} - Y_{kU}) \sin \left[\frac{\pi}{2} \left(\frac{\psi - \psi_{1}}{\psi_{2} - \psi_{1}}\right)^{2}\right]^{2}, \\ \psi_{1} \leq \psi_{-} < \psi_{2} \\ Y_{kB}, & \psi_{2} \leq \psi \leq \psi_{R}. \end{cases}$$

$$(37)$$

The temperature T is defined similarly.

This particular definition will give us $T = T_{CR}$ at $\psi_{CR} = 0.5(\psi_L + \psi_R)$. The choice of the particular function that defines the Y_k and T between ψ_1 and ψ_2 is not important. We have used a straight line with success, but defining a smooth function is slightly more efficient.

A requirement of PDECOL is that the initial profiles satisfy the boundary conditions, in our case given by Eqs. (17) and (18). The above initial profiles have the proper unburned values at ψ_L and are constant (space derivative zero) near ψ_D .

For this case the subroutine BNDRY has a simple form. At ψ_L , the subroutine returns the values $\partial b_k/\partial u_k=1$, $\partial b_k/\partial u_{k\psi}=0$, and $\partial Z_k/\partial t=0$. At ψ_R , the conditions are $\partial b_k/\partial u_j=0$, $\partial b_k/\partial u_{k\psi}=1$, and $\partial Z_k/\partial t=0$.

To begin the integration, a starting value for m , the mass flux through the origin is required. To do this, the code ignores the time dependent terms, assumes that the mass flux ρv is constant, and uses Eq. (20) to obtain a value of ρv . This gives a reasonable starting value for m_o.

The evaluation of Eq. (20) is carried out in the subroutine FLSP. The integral is approximated using the trapezoidal rule, where the integrand $R_k^{}$ M_k/ρ is calculated at the evaluation points. The flame speed $v_k^{}(-\infty)$ is evaluated for each species k and for several intervals (a,b), where a = ψ_L . The initial value for $m_0^{}$ is based on species N-1 integrated over the entire interval $(\psi_L^{}, \psi_R^{})$.

The integration is performed over several intervals (a,b) because of the behavior of the minor species. These are normally close to zero at ψ_L , reach a peak in the flame front, and are close to zero again at ψ_R . For these species, integrating from the left boundary to the flame front is much more accurate.

The chemistry terms in Eq. (20) are found by calling RT. The diffusion terms for this case are found using Ficks law, Eq. (22). Since we are assuming that $\rho^2 D_{km}$ is constant, this value is stored in the vector R2D. The subroutine FLSP also computes the x values from the relation

$$x (t, \psi) = \psi_{\infty} \int_{\psi_{L}}^{\psi} \rho^{-1} d \psi, \qquad (38)$$

using the trapezoidal rule, and computes an estimate of the flame thickness.

As the time integration proceeds, control returns to MAIN at a series of output times. The present spatial location of the temperature $T_{\rm cn}$ is found, and this is used to find the average value of the mass flux since the last output time. The function $m_{\rm o}(t)$ is redefined at these times so as to keep the flame front in roughly the same position. The output times are chosen by the program so that the flame front will not drift too far between evaluations. Also FLSP is called so the user can see if the flame speeds computed from the different species profiles are approaching a common value.

At the final time t_{FINAL} , FLSP also writes an output file. It consists of all the evaluation points ψ_i , the corresponding x_i , the

values of Y_k and T, plus their first and second derivatives with respect to ψ . This file can be attached to an output routine. By also attaching F and RT, we can compute and print out any quantity in the steady state solution in which we are interested. This file can also be attached to a graphics routine.

Similarly, the program MAIN writes a restart file. This consists of the present location of \mathbf{T}_{cn} , the present value of \mathbf{m}_{o} , and the values of \mathbf{Y}_{k} and T at the collocation points. This file can be used to restart the time integration. It is attached to TAPE1, and the parameter NSTART is set equal to 2. The input parameters read in on cards can now be changed if desired. UINIT will translate these input values to center the flame front, and will use interpolation to find the appropriate values of the starting profiles at the new collocation points. The old value of \mathbf{m}_{o} is used to start the integration.

So far only the constant transport case (NTRAN = 1) has been considered. For more realistic algorithms F is written by an auxiliary code and attached to the flame code (NTRAN) = 2). Several different levels of approximation can be used. $^{\circ}$

In these more complicated algorithms, the diffusion velocities V_k are coupled, and they must be computed simultaneously. But since the code uses successive calculation, only the value of one V_k is required on each call to F. Because the computation is time-consuming, it is preferable not to compute the V_k N times at each time step for each collocation point. To economize computer time, all the thermodynamic and transport quantities required at all the collocation points for k=1 are computed, and stored in vectors. For k>1, we use the same values, even though some of the Y_k terms have changed slightly. Only the chemistry terms are reevaluated. Since the chemistry normally changes much more rapidly than the transport, this will still be a good approximation.

In generating an approximation to the Jacobian (using finite differences) it is necessary to recompute the transport each time F is called, since what is of interest is the effect of changes in Y_k and T on the time derivatives. Ignoring the changes in transport leads to an inaccurate Jacobian. However, the rate constants k_j and the thermodynamic quantities c_p and h_k need be recomputed only if T is changed, since they only depend on temperature.

As will be seen in the next section it will still be useful to formulate the mass flux in a Ficks law form Eq. (22). For the more complicated transport subroutines, we define

$$\rho^{2} p_{km} = -\frac{\psi_{\infty} \rho Y_{k} V_{k}}{\partial Y_{k} / \partial \psi} . \tag{39}$$

This new quantity $\rho^2 D_{km}$ is no longer constant with respect to space or time.

VI. BURNER STABILIZED FLAMES

So far we have only discussed flames that propagate in an unbounded medium. In actual experiments, the flame will usually be stabilized by a burner. It is useful to be able to model this type of experiment so that we can compare experimental and calculated profiles.

Our basic idealization is of a cylindrical, porous plug burner. The premixed gas exits the plug with a constant velocity v, but the plug prevents back diffusion of the products into the burner. When the gas is ignited, a flame front develops and propagates toward the burner. The gas velocity v at the burner must be less than the flame velocity, or the flame will be blown off the burner. In the model this will look like an unbounded flame. In an experiment the flame will be extinguished by the surrounding atmosphere. As the flame approaches the burner, the burner surface acts as a heat sink for the flame. The loss of heat slows down the flame velocity, until the flame stabilizes near the surface of the burner at the gas velocity. As the gas velocity v is decreased, the flame loses more heat to the burner, and stabilizes closer to the burner surface. If v is made too small in an experiment, the flame can flash back into the burner.

For this kind of burner, air is entrained along the outside edges of the flame. However, the center of the flame will correspond closely to a premixed, laminar, one-dimensional flame.

The only change in the equations is in the left boundary condition at the surface of the burner. Because of back diffusion from the flame to the burner surface, the mass fractions of the unburned mixture are not conserved. However, due to conservation of mass, the mass flux fractions, defined as

$$\varepsilon_{k} = \frac{\rho Y_{k} V + \rho Y_{k} V_{k}}{\rho V} = Y_{k} + \frac{\rho Y_{k} V_{k}}{\rho V}$$
(40)

are conserved. Within the burner, the diffusion velocities are zero, and $\epsilon_{kU} = Y_{kU}$. So the appropriate boundary conditions at the burner surface are

$$\varepsilon_{k} = Y_{kll} \cdot \tag{41}$$

The boundary conditions for the temperature equation depends on how heat

is extracted. We assume that the burner is maintained at a constant temperature. Then the boundary condition is the same as for an unbounded flame,

$$T = T_{U}. \tag{42}$$

This idealization is discussed by Hirshfelder, Curtiss and $Bird^{12}$.

To implement this in the flame code, the input parameter NBURN is set equal to 1. The fluid velocity at the burner must be specified. Then m is a predetermined constant instead of an adjustable parameter. All the other input data remains the same. However, the code will handle this data differently.

The breakpoints are generated differently, since the flame front will be near the left boundary instead of in the center of the interval of integration. NCN is the number of intervals of equal length at the left boundary. FC is the ratio between the longest interval (at the right boundary) and the shortest interval (at the left boundary). The constant α is now defined by

$$\alpha = \log^{-1} \left[(\log FC) / (NINT-NCN) \right]. \tag{43}$$

The common length LC of the NCN shortest intervals is now

$$LC = L/[NCN + \alpha(\alpha^{(NINT-NCN)}-1)/(\alpha-1)]. \tag{44}$$

As an example, consider the same input parameters that we used for an unbounded flame; ψ_L = 0, ψ_R = 10, NINT = 12, NCN =4, and FC = 6. Then L = 10, α = 1.2510 and LC = .4181. The resulting breakpoint sequence is given in Table 2. The shortest intervals are near the burner surface, where fairly steep gradients are expected.

In general, it is possible to choose a shorter interval of integration L for a burner stabilized flame. There is no longer a need for a relatively long interval to the left of the flame front in order to approach the unburned conditions. The number of breakpoints can then also be reduced.

The initial profiles are also chosen differently. The code sets

¹² J.O. Hirshfelder, C.F. Curtiss, and R.B. Bird, op. cit., pp. 761-763.

TABLE 2. THE SET OF BREAKPOINTS GENERATED BY L=10, NINT = 12, NCN = 4 and FC = 6 (NBURN = 1)

| Breakpoints | Interval Lengths | |
|---|------------------|--------------|
| 0 | .3458 | |
| .3458 | .3458 | |
| .6916 1.0374 | .3458 | |
| 1.3832 | ,3458 | |
| 1.8159 | .5412 | |
| 2.3571 | .6771 | |
| 3.0342 3.8812 | .8471 | |
| 4.9409 | 1.0597 | |
| 6.2666 | 1.6585 | |
| 7.9251 10.0000 | 2.0749 | |
| | | |
| $\psi_1 = \psi_L + 0.1 \ (\psi_R - \psi_L)$ | • | (45 <u>)</u> |
| $\psi_2 = \psi_L + 0.3 \ (\psi_R - \psi_L)$ | | (· · ·) |

and then uses Eq. (37) as before. This flame front is more likely to be close to the position of the final steady state stabilized flame. Also, the flame front is chosen to be narrower. If Eq. (36) is used, the initial transient flame velocity may be less than the velocity of the fluid. The flame then drifts toward the right, and can be carried completely outside the interval of integration before it stabilizes. Choosing a steeper flame front leads to a larger initial flame velocity.

The boundary condition, Eq. (41), can cause some difficulty. It is fairly straightforward for the constant transport case. Using Fick's law, Eq. (22), it can be rewritten as

$$Y_{k} - \left(\frac{\rho^{2} D_{km}}{\psi_{\infty}} m_{o} \frac{\partial Y_{k}}{\partial \psi}\right) \Big|_{\psi_{L}} = Y_{U} . \qquad (46)$$

Recall that PDECOL converts this to a time dependent equation by taking the time derivative. In the form used by PDECOL, Eq. (46) becomes

$$\left[\frac{\partial Y_k}{\partial t} - \frac{\rho^2 D_{km}}{\psi_{\infty} m_0} \frac{\partial}{\partial t} \left(\frac{\partial Y_k}{\partial \psi} \right) \right] \Big|_{\psi_L} = 0 . \tag{47}$$

So the subroutine BNDRY must now return the values $\partial b_k/\partial u_k=1$, $\partial b_k/\partial u_k=-\rho^2\,D_{km}/\psi_\infty\,m_0$, and $\partial Z_k/\partial t=0$ at ψ_L for k=1,2... N - 1. The mass flux fractions will then have the proper values as the integration proceeds.

For more realistic transport algorithms the mass flux ρ Y_k V_k is a complicated function of all the mass fractions. But by using Eq. (39) to define ρ^2 D_{km} , the boundary condition can be put in the same form as Eq. (46), except that ρ $^2D_{km}$ is not a constant. Taking the time derivative we obtain

$$\left\{ \frac{\partial^{Y} k}{\partial t} - \frac{\rho^{2} D_{km}}{\psi_{\infty} m_{0}} \frac{\partial}{\partial t} \left(\frac{\partial^{Y} k}{\partial \psi} \right) - \frac{1}{\psi_{\infty} m_{0}} \frac{\partial}{\partial t} \left(\rho^{2} D_{km} \right) \frac{\partial^{Y} k}{\partial \psi} \right\} \Big|_{\psi_{L}} = 0. \quad (48)$$

The time derivative of ρ^2 D_{km} can not be evaluated. It is not possible to write it as an explicit function of the Y_k and $\partial Y_k/\partial \psi$. Moreover, since the code uses successive calculation, cross coupling terms between the different species are not allowed. By necessity, the last term in Eq. (48) must be ignored.

It is possible to just use the expression

$$\left\{ \frac{\partial Y_{k}}{\partial t} - \frac{\rho^{2} D_{km}}{\psi_{\infty} m_{0}} \frac{\partial}{\partial t} \left(\frac{\partial Y_{k}}{\partial \psi} \right) \right\} \Big|_{\psi_{L}} = 0$$
(49)

as the boundary condition. At steady state, the mass flux fractions will approach constants. But because of the transient behavior of $\rho^2 D_{km}$.

the mass flux fractions will converge to incorrect values.

What is required is a correction term that will cause the code to converge to the proper steady state limit. Moreover, it must be of a form that can be used in the code. This can be done by choosing the boundary condition

$$\left\{ \frac{\partial Y_k}{\partial t} - \frac{\rho^2 D_{km}}{\psi_{\infty}^{m_0}} \frac{\partial}{\partial t} \left(\frac{\partial Y_k}{\partial \psi} \right) \right\} \psi_L = \frac{\partial Z}{\partial t} , \qquad (50)$$

where

$$\frac{\partial Z}{\partial t} = \frac{Y_{kU} - \varepsilon_{k|\psi_L}}{0.1 t_{FINAL}}.$$
 (51)

The rationale is that $\rho^2 D_{km}$ changes rather slowly. As it changes the mass flux fraction at ψ_L will change slowly from the proper value. We use a heuristically defined function $\partial Z/\partial t$ to modify the value of ε_k until it again equals Y_k . So as the time integration proceeds, the value of ε_k at ψ_L will vary slightly, but will approach the proper steady state limit.

It is necessary to check that the boundary conditions are still consistent with the initial conditions. For the initial profiles defined by Eq. (37) this will be the case. The mass fractions Y_k are constant near ψ_L , so $\partial Y_k/\partial \psi$ at ψ_L will be zero. Also $\partial T/\partial \psi$ at ψ_L is zero. For any transport algorithm all the V_k will be zero at ψ_L , and $\varepsilon_k = Y_k$. So the initial profile is consistent with the boundary conditions.

When the integration is restarted (NSTART = 2), the space derivatives at ψ_L are normally non-zero. It is necessary to modify the way PDECOL determines the initial values of $c_k^{(i)}$. Normally this is done by the subroutine INITAL. It calls the user supplied subroutine UINIT to obtain the values $u_k(t_0,\psi_j)$, where the ψ_j , j=1,2... NC are the collocation points. Then by substituting into the expansion (29), it obtains a set of linear algebraic equations of the form

$$u_{k}(t_{o}, \psi_{j}) = \sum_{i=1}^{NC} c_{k}^{(i)}(t_{o}) B_{i}(\psi_{j}) k = 1, 2...N, j = 1, 2...NC. (52)$$

These systems of equations are solved to obtain the initial $c_k^{(i)}(t_o)$.

For a burner stabilized flame, the appropriate values of the mass fractions at $\psi_1 = \psi_L$ are not known but the values of the mass flux fractions ε_k are. Thus, we use the boundary condition (46), substitute the expansion (29), and obtain

$$Y_{kU} = \sum_{i=1}^{NC} c_k^{(i)}(t_0) \left[B_i(\psi_1) - \frac{\rho^2 D_{km}}{\psi_{\infty}} - \frac{\partial B_i(\psi_1)}{\partial \psi} \right], k=1,2...N-1. (53)$$

The values of ρ^2 D_{km} from the last run of the code are used. These values are also saved in the restart file. So for a burner stabilized flame, the subroutine INITAL has been changed so that it generates this new set of equations for j = 1, k = 1, 2...N - 1.

Note that the above procedure is not strictly necessary. Since we have a correction term $\partial Z/\partial t$, the boundary conditions will approach the proper values, even if they are incorrect at the start of the integration. But it is more efficient to begin with the boundary conditions as accurate as possible.

To actually make comparisons with experiments, some of the boundary conditions may have to be further modified. For instance, evidence exists that hydrogen atoms H combine very rapidly on the burner surface to form $\rm H_2.^{13}$ For practical purposes, we consider this to be instantaneous. Then if our first species is H and our second species is $\rm H_2$, their boundary conditions are

$$Y_1 = 0 \quad \text{at } \psi_L \tag{54}$$

and

$$\varepsilon_1 + \varepsilon_2 = Y_{2u}$$
 at ψ_L . (55)

These changes can easily be made in UINIT and INITAL.

As the time integration proceeds, control returns to the routine MAIN at five equally spaced output times. The code calls subroutine FLSP so the integration process can be monitored. There is no need to adjust \mathbf{m}_{O} , since this is now a predetermined constant.

¹³ J. Warnatz, "Calculation of the Structure of Laminar Flat Flames III: Structure of Burner-Stabilized Hydrogen-Oxygen and Hydrogen-Fluorine Flames", Verlog Chemie GmbH. BdB 8/78 E 4018.

VII. NUMERICAL CONSIDERATIONS

This code has been applied to the $\rm H_2-O_2-N_2$ system, with nine chemical species. An earlier version of the code has been applied to the ozone system, with three species 14. Several calculations have been performed for methane-air flames. In each case the code integrates in time until the steady state solution has been reached. What is desired is accurate values for the flame speed and accurate temperature and species profiles. Results are not discussed here, since they are given in the papers referenced above. Instead, we will discuss some of the considerations necessary to obtain accurate results, based on our experiences with the above systems.

The flame speed can be calculated from any of the species profiles using Eq. (20). Normally the time integration proceeds until the flame speeds based on the major species (reactants and products) agree to within a small fraction of a percent. At this point the solution is very close to steady state. The values of the flame speed calculated from the minor species (radicals) are very sensitive, and require more accuracy (both spatial and temporal) in order to achieve the same agreement.

In general, it is easier to obtain an accurate solution for a fast flame than for a slow flame. The slow flame requires many more integration steps before all the oscillations die out and a steady state solution is achieved.

To obtain an accurate solution, both the spatial and temporal accuracy must be sufficient. If the temporal accuracy is low, the calculated flame speeds can oscillate around the correct value. If the spatial accuracy is low, the problem may come very close to convergence, but to the wrong value, since the communication between the collocation points is inadequate. As a consequence of the spatial or temporal accuracy becoming too small, the integration may break down completely.

Spatial accuracy is more important in the flame front, where we have steep gradients. Hence, our algorithms for choosing breakpoints concentrates them in the region to be occupied by the flame front.

The need for spatial and temporal accuracy is connected. Suppose the number of breakpoints is increased, but the temporal error tolerance ϵ is not decreased. The calculated solutions will oscillate, and eventually the solution will break up. On the other hand, suppose ϵ is decreased but the breakpoint sequence is not changed. We can still obtain an

¹⁴ J.M. Heimerl and T.P. Coffee, "The Detailed Modeling of Premixed, Laminar Steady-State Flames. I. Ozone", Combustion and Flame, Volume 39, pp. 301-315, 1980.

answer, but the integration will take longer, and the accuracy of the solution is not increased. At this stage, the appropriate value of ϵ for a given breakpoint sequence is a matter of trial and error.

An additional problem can occur with very slow flames. If the interval of integration is chosen too small, there may be a noticeable gradient in the temperature profile at the cold boundary. Since the gas is entering through the cold boundary quite slowly, this can result in a substantial heat loss through the boundary. This heat loss will slow down the flame. The integration will converge, but the computed flame speed will be too low. This effect can occur for any flame. However, for most flames, a noticeable heat loss is due to a fairly steep temperature gradient at the boundary. It is then obvious that the interval of integration must be increased. But for a slow flame (less than 20 cm/sec) a noticeable error in the flame speed can result (5 to 10 percent), even when the gradient at the cold boundary appears negligible.

Most of the cases we have run have been with NINT = 12, KORD = 4 and NCC = 2 (13 breakpoints, 26 collocation points). We have let $\varepsilon = 10^{-3}$, and SREC = 10^{-6} . The number of central intervals NCN was 4, and the ratio FC between the longest and shortest intervals was between 4 and 8.

The length of the interval of integration L, as well as the optimum value for FC, is a matter of trial and error. However, a reasonable set of breakpoints can be found fairly easily by experimenting with the above scheme, using the constant transport subroutine. The code can then be run with a more realistic transport algorithm, using the restart option.

To make sure that convergence was obtained, the code was also run with NINT = 16 and ϵ = 3 x 10-4 for a number of cases. Only negligible differences occurred.

The program was run on the BRL CYBER 76. For hydrogen-oxygen flames, the run time varied from about 30 seconds with the simpliest transport subroutine to 5 minutes or more for the most complicated case.

An earlier version of this code was applied to the solution of an unbounded ozone flame 14 . The successive calculation procedure was not implemented at that time. However, since the number of species is so small, the savings in reducing the size of the Jacobian is not very important.

At that time we reported using NINT = 57 to NINT = 70, KORD = 6 and NCC = 5. The number of collocation points was then between 62 and 75. We have now been able to solve this case with equal accuracy using NINT = 12, KORD = 4, and NCC = 2. Partly this is due to choosing NCC = 2. The program then generates a special choice of collocation points (Gauss - Legendre quadrature points in each subinterval) which gives increased spatial accuracy. More important is the improved algorithm for choosing breakpoints. By using a little more care, a much smaller set of breakpoints can still reproduce the flame with sufficient accuracy. So the careful choice of breakpoints is probably the most important consideration in running the code efficiently.

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 J. M. Heimerl and T. P. Coffee, "The Detailed Modeling of Premixed, Laminar Steady-State Flames. I. Ozone", Combustion and Flame, Volume 39, pp. 301-315, 1980. APPENDIX A

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APPENDIX A

A listing of the computer code follows. The subroutines MAIN, F, UINIT, FLSP, BNDRY, BKPT, and RT are written for laminar flame problems. The subroutine F given is for the constant transport assumption. The subroutine RT given is for a $\rm H_2-\rm O_2-\rm N_2$ flame. There are nine chemical species and thirty reactions.

The rest of the subroutines are from PDECOL. They have been modified as discussed in the text.

After the listing, the job stream and output is given for a typical hydrogen-oxygen flame. The initial unburned gas is 50% H₂ and 50% air, where air is 21% O₂ and 79% N₂. The nitrogen is considered to be a diluent, and does not react. The required starting information is attached to TAPE11. The main program and the subroutine RT are attached in a compiled form. The integration begins from the initial profiles (37). At the final output time, the flame speed and the temperature and species profiles are given, as well as the corresponding x values. The restart file is written on TAPE 2, and the output file on TAPE 9. Both files are catalogued for possible future use.

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| 412 FORMATIES 14 (2) KLINTKN 11 (K) 110 (K) 11 | | | | | |
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| 412 FORMATION STATES AND STATES A | | | | 2 4 | 3.0 |
| 412 F COMMAN (1844XA10:10-20:10-4) 425 CONTINUE 426 NEDERNOR: 426 NEDERNOR: 430 FEM (1844XA10:10-20:10-4) 431 FEM (15-43) DEM (1840) 432 FEM (15-43) DEM (1840) 433 FEM (15-43) DEM (1840) 444 TITE (13-43) DEM (1840) 445 FEM (15-43) DEM (1840) 446 FEM (15-43) DEM (1840) 447 FEM (15-43) DEM (1840) 448 FEM (15-43) DEM (1840) 448 FEM (15-43) DEM (1840) 448 FEM (15-43) DEM (1840) 449 FEM (15-445) DEM (1840) 440 FEM (15-445) DEM (1840) 441 FEM (1840) DEM (1840) 441 FEM (1840) DEM (1840) 442 FEM (1840) DEM (1840) 443 FEM (1840) DEM (1840) 444 FEM (1840) DEM (1840) 444 FEM (1840) DEM (1840) 445 FEM (1840) DEM (1840) 446 FEM (1840) DEM (1840) 447 FEM (1840) DEM (1840) 448 FEM (1840) DEM (1840) 449 FEM (1840) DEM (1840) 440 FEM (1840) DEM (1840) 440 FEM (1840) DEM (1840) 441 FEM (1840) DEM (1840) 441 FEM (1840) DEM (1840) 442 FEM (1840) DEM (1840) 444 FEM (1840) DEM (1840) 444 FEM (1840) DEM (1840) 445 FEM (1840) DEM (1840) 446 FEM (1840) DEM (1840) 447 FEM (1840) DEM (1840) 448 FEM (1840) DEM (1840) 449 FEM (1840) DEM (1840) 440 FEM (1840) DEM (1840) 441 FEM (1840) DEM (1840) 444 FEM (1840) DEM (1840) 445 FEM (1840) DEM (1840) 446 FEM (1840) DEM (1840) 447 FEM (1840) DEM (1840) 448 FEM (1840) DEM (1840) 449 FEM (1840) DEM (1840) 440 FEM (1840) DEM (1840) 440 FEM (1840) DEM (1840) 440 FEM (1840) DEM (1840) 441 FEM (1840) DEM (1840) 442 FEM (1840) DEM (1840) 444 FEM (1840) DEM (1840) 445 FEM (1840) DEM (1840) 446 FEM (1840) DEM (1840) 447 FEM (1840) DEM (1840) 448 FEM (1840) DEM (1840) 449 FEM (1840) DEM (1840) 440 FEM (1840) DEM (1840) 441 FEM (1840) DEM (1840) 444 FEM (1840) DEM (1840) 445 FEM (1840) DEM (1840) 446 FEM (1840) DEM (1840) 447 FEM (1840) DEM (1840) 448 FEM (1840) DEM (1840) 449 FEM (1840) DEM | | | 121KelH(K) + 4(K) + (0(K) + (0) + (K) + (0) + (K) + (K | | 4 |
| 425 CONTINUE 4 READ 15-4010 LORINDE 1) READ 15-4010 LORINDE 1) READ 15-4010 LORINDE 1) READ 15-4010 LORINDE 1) READ 15-4010 LORINDE 10 HIGHDE 1 READ 15-4010 LORINGE 17 HIGHDE 17 HI | | | *4X*A10*1P5E12*4) | 2 : 4 : 4 : 2 : 4 : 4 : 4 : 4 : 4 : 4 : | 2 |
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| Head (11 + 42) Line (New P. P.) | | | • | 214 | 29 |
| 4.30 ΓΡΑΦΙΙΙΡΟΙΕΙ ««ΕΚΕΙΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΑΙ ΕΝΕΙΙΙΑΙ ΕΝΕΙΙΙΑΙ ΕΝΕΙΙΙΑΙ ΕΝΕΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΙΙΑΙ ΕΝΕΙΙΙΙΑΙ ΕΝΕΙΙΙΙΙΙΙΑΙ ΕΝΕΙΙΙΙΙΙΙΑΙ ΕΝΕΙΙΙΙΙΙΙΑΙ ΕΝΕΙΙΙΙΙΙΑΙ ΕΝΕΙΙΙΙΙΙΙΙΙΙ | | 0 1 4 2 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 | G (NDO) E | ZIAN | 63 |
| 4.00 FG-MAILED 112.4.) 4.10 FG-MAILED 112.4.) 4.11 FG-MAILED 112.4.) 4.11 FG-MAILED 112.4.) 4.11 FG-MAILED 112.4.) 4.12 FG-MAILED 112.4.) 4.13 FG-MAILED 112.4.) 4.14 FG-MAILED 112.4.) 4.15 FG-MAILED 112.4.) 4.16 FG-MAILED 112.4.) 4.17 FG-MAILED 112.4.) 4.18 FG-MAILED 112.4.) 4.19 FG-MAILED 112.4.) 4.10 FG-MAILED 112.4.) 4.11 FG-MAILED 112.4.) 4.11 FG-MAILED 112.4.) 4.12 FG-MAILED 112.4.) 4.13 FG-MAILED 114.4. 4.14 FG-MAILED 114.4. 4.15 FG-MAILED 114.4. 4.16 FG-MAILED 114.4. 4.17 FG-MAILED 114.4. 4.18 FG-MAILED 114.4. 4.19 FG-MAILED 114.4. 4.10 FG-MAILED 114.4. 4.10 FG-MAILED 114.4. 4.11 FG-MAILED 114.4. 4.11 FG-MAILED 114.4. 4.12 FG-MAILED 114.4. 4.13 FG-MAILED 114.4. 4.14 FG-MAILED 114.4. 4.15 FG-MAILED 114.4. 4.16 FG-MAILED 114.4. 4.17 FG-MAILED 114.4. 4.18 FG-MAILED 114.4. 4.19 FG-MAILED 114.4. 4.10 FG-MAILED 1 | | | The state of the s | Z | 4 |
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| #### ################################# | Ç | HE AD (5.430 | 0) TPN• PIN• 1 MN | Z 4 1 | 0 ! |
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| 460 FOURT (1710 × 1917 = 1 PE 12 + 4 5 × 4 × 17 PE 12 + 4 + 17 PE | | UC (NPUE) = L | UC INFUELY IF IT | | |
| ## ITE (3*460) UC (NPDE) 19 (NPDE) 4 ## ITE (3*460) UC (NPDE) 4 ## ITE (3*465) TENDE HAVE THE \$= 1PE 12*4*5 X*47H = 1PE 12*4*5 ## ITE (3*465) TENDE HAVE THE \$= 1PE 12*4*5 X*47H = 1PE 12*4*5 X*5HTMM = 1PE 12*4*5 X*6*1 X*6* | | J= (304N) HG | UR (NFDE) / 1FN | ? 4 | 2 |
| 460 FURNATION (X-AHTC = 1) FELS (X-4) S X + 2 HTE (3-45) S HTHM = 1) FELS (X-5) S HTMM = 1, FELS (X-5) S HTMM | 7.0 | A4. 17. 13.44 | (NDDE) • TH (NDDE) | ZIV | 7 |
| 466 CONTRICTORY CO | 2 | | 14. C. 10. 10. 10. 10. 10. 10. 10. 10. 10. 10 | MAIN | 72 |
| 465 WKITE (3445) FRAFFANT AND | | | | | |
| 465 FORMATION SANTHUM =: IPELE 4.55.45HMM =: 4 FELL 2.45.54 FELL 2.45. | | 34. UE (0.44. | | 2 | 3 |
| ** IFEIE-47)** ** THERE IN TOXAGE AND TOWN THE IS A STANDARY AND TOWN TO TOWN TO TOWN TO TOWN TOWN TOWN | | | =.1Pt12.4.5X.5HTMN = | ZIVE | 7.7 |
| ### ### ############################## | | 1 | | Z A M | 7. |
| ### ### ############################## | | 1 PE 1 C - 4 / 1 | | | , , |
| 470 F UNMAIL/LIORS SHOPPELS. 4.5 5.4 4.Ht. =:IPE12.4.55.4. 471 FENI =:IPE12.4.5 HE IS. 4.5 HE RIGHT BUNNDAKY. C ENHOW IS THE LEFT BOUNDAKY. PHS IS IME RIGHT BUNNDAKY. C ENHOW IS MESSURED BY (YL-4.9) MAXIVIC. SHEEL. C IF NSIART = 2. REGIN FROM A GUESSED PROFILE. C IF NSIART = 2. REGIN FROM A PROFILE. ON TAPE!. C IF NBIART = 2. REGIN FROM A PROFILE. C IF NBIART = 2. REGIN FROM A PROFILE. C IF NBIAN = 1. SPECIFY THE INCOMINO FULLO VELULITY (CM/SEC). C IF NBIAN = 1. THE SHORT WERSION OF FIS USEU. MEAD(5.43.0) PHO PHS FISTINAL. 430 FUHAR (134.4) PEE2.4) 431 FUHAR (134.4) PEE2.4) 434 FUHAR (134.4) PEE2.4) 435 FUHAR (134.4) PEE2.4 436 FUHAR (100.8) SHED = 1.PE IZ. 4.5 5 × 6 H: INT = 1.PE IZ. 4.5 × 7 H HI (134.4) PEE1.4 436 FUHAR (100.8) SHED = 1.PE IZ. 4.7 437 FUHAR (100.8) SHED = 1.PE IZ. 4.7 438 FUHAR (134.4) PEE1.4 439 FUHAR (134.4) PEE1.4 430 FUHAR (100.8) HIRAN (100.8) 431 FUHAR (100.8) HIRAN (100.8) 432 FUHAR (100.8) HIRAN (100.8) 433 FUHAR (100.8) HIRAN (100.8) 434 FUHAR (100.8) HIRAN (100.8) 435 FUHAR (100.8) HIRAN (100.8) 436 FUHAR (100.8) HIRAN (100.8) 437 FUHAR (100.8) HIRAN (100.8) 438 FUHAR (100.8) HIRAN (100.8) 439 FUHAR (100.8) HIRAN (100.8) 400.6 FUHAR (100.8) | 22 | L++E) 31 [14 | . • TPENT | 7 | 0 |
| ### ### ############################## | • | | = 1PF 12.4.54.4HW = 1PE 12.4.5X | ZIVI | 11 |
| C FHOM IS THE LEFT BOUNDARY. PHS IS THE HIGHT BOUNDARY. C FHOW IS HEASURED BY (YL-YP)/MAXY(x.SRE) C IF NSIART = 2. REGIN FHUM A UNESSED PROFILE. C IF NSIART = 2. REGIN FHUM A UNESSED PROFILE. C IF NSIART = 2. REGIN FHUM A UNESSED PROFILE. C IF NHIGHN = 1. PRE SHORT HE NO NIT PLULITY (CM/SEC). C IF NHIGHN = 1. SPECIFY THE UNCOMING PLULY VELULITY (CM/SEC). C IF NHIGHN = 1. SPECIFY THE UNCOMING PLULY VELULITY (CM/SEC). C IF NHIGHN = 1. SPECIFY THE UNCOMING PLULY VELULITY (CM/SEC). C IF NHIGHN = 1. SPECIFY THE UNCOMING PLULY VELULITY (CM/SEC). C IF NHIGHN = 1. SPECIFY THE UNCOMING PLULY VELULITY (CM/SEC). C IF NHIGHN = 1. SPECIFY THE UNCOMING PLULY VELULITY (CM/SEC). C IF NHIGHN = 1. SPECIFY THE UNCOMING PLULY VELULITY (CM/SEC). C IF NHIGHN = 1. SPECIFY THE UNCOMING PLULY VELULITY (CM/SEC). C HAT IT (10x, SHEP) = 1. PEL 2.4. SX *********************************** | | | | 7144 | 4 |
| C EHHON IS HELEFT BOUNDARY? C EHHON IS HELEFT BOUNDARY? C IF NSTART = 1.0 REGIN FHOM A GUESSE! PROFILE. C IF NSTART = 2.0 REGIN FHOM A GUESSE! PROFILE. C IF NSTART = 2.0 REGIN FHOM A BROFILE. ON TAPE!. C IF NSTART = 2.0 REGIN FHOM A BROFILE. C IF NSTART = 2.0 REGIN FHOM A BROFILE. C IF NSTART = 2.0 REGIN FHOM A PROFILE. C IF NSTART = 2.0 REGIN FHOM A BROFILE. C IF NSTART = 2.0 REGIN FHOM A BROFILE. C IF NSTART = 2.0 REGIN FINAL FERSION OF 1 IS USEU. C IF NSTART = 2.0 REGIN FINAL RESIDE. C IF RESIDE. C IF RESIDE. C IF RESIDE. C IF NSTART = 2.0 REGIN FINAL RESIDE. C IF | | | The State of the S | | |
| C IF NSTART = 1.8 REGIN FWOM & GUESE! PROFILE. C IF NSTART = 2.8 REGIN FWOM & GUESE! PROFILE. C IF NSTART = 2.8 REGIN FWOM & GUESE! PROFILE. C IF NHURN = 1.9 REGIN FWOM & GUESE! PROFILE. C IF NHURN = 1.9 FEAT FLAME. C IF NHURN = 1.5 FEAT FLAME. C IF NHURN = 1.5 FEAT FLAME. C IF NHURN = 2.4 ALONG WESTION IS USE!. READ(5.420) PROFILE. C IF NHURN = 2.4 ALONG WESTION IS USE!. READ(5.420) NHURN FLIND HATE(5.420) NHURN FLIND HATE(5.430) NHURN HAT | | | EFT BOUNDARY. PHS IS THE RIGHT BOUNDARY. | 2 4 5 | Č |
| C IF NSTART = 1. REGIN FHOM A GUESE!! PROFILE. C IF NUTURN = 2. BEGIN FHOM A PROFILE. ON TAPE!. C IF NUTURN = 1. FEGIN FHOM A PROFILE. ON TAPE!. C IF NUTURN = 1. FEGIN FHOM A PROFILE. C IF NUTURN = 1. FEGIN FHOM A PROFILE. C IF NUTURN = 1. FEGIN FHOM PROMING PLUID VELOCITY(CM/SEC). C IF NUTURN = 1. FEGIN FHOM PROMING PLUID VELOCITY(CM/SEC). C IF NUTURN = 2. A LONG VESSION OF P IS USEU. C IF NUTURN = 2. A LONG VESSION OF P IS USEU. C IF NUTURN = 2. A LONG VESSION OF P IS USEU. C IF NUTURN = 2. PEGIS = 3. C IF NUTURN = 2. PEGIS = 3. WHITE (3.445) NSTARTANINI.NBURN/FLUSP COMMATICIOX.SHPHO = 1.PEI2.44) WHITE (3.445) NSTARTANINI.NBURN/FLUSP COMMATICIOX.SHPHO = 1.PEI2.44) WHITE (3.445) NYRANIPHI = 1.445,X.*HHIV-INI = 1.PEI2.47) C THAX IS THE MAXIMUM PUN TIME ALL UNF C THAX IS THE MAXIMUM PUN TIME ALL UNF C THAX IS THE MAXIMUM PUN TIME ALL UNF C THAX IS THE MAXIMUM = 1.PEI2.44) WHITE (3.445) NYRANIPHIAX C THAX IS THE MAXIMUM = 1.PEI2.47) C THAX IS THE MAXIMUM = 1.PEI2.47) WHITE (3.445) NORMY C CHAM ICA 1.PEI2.49 WHITE (3.445) NORMY C C THAX IS THE MAXIMUM = 1.PEI2.44) WHITE (3.445) NORMY C C THAX IS THE MAXIMUM = 1.PEI2.44) WHITE (3.445) NORMY C C THAX IS THE MAXIMUM = 1.PEI2.44) WHITE (3.445) NORMY C C THAX IS THE MAXIMUM = 1.PEI2.44) WHITE (3.445) NORMY C C THAX IS THE MAXIMUM = 1.PEI2.44) WHITE (3.445) NORMY C C THAX ICA 1.PEI2.40 | | | SURFO BY (YC-YP)/MAX(YC.SREC) | HAM | 90 |
| C IF NSTART = 2.8 GEIN FROM A DESCRIPTION TABLE. C IF NHURN = 10. UNBOUNDED FLAME. C IF NHURN = 10. TEAT FLAME BUNNER AT PH = 0. C IF NHURN = 1. FEETF FLAME BUNNER AT PH = 0. C IF NHURN = 1. FEETF FLAME BUNNER AT PH = 0. C IF NHAN = 2. A LONG VERSION OF 1 IS USEU. KEAD(5.430) NHO.PHS. TI NAL. EPS. S. C. C. FEETF FLAME REAG(5.430) NHO.PHS. TI NAL. EPS. S. C. C. FEETF FLAME C. S. D. NHAN = 2. A LONG VERSION OF 1 IS USEU. KEAD(5.430) NHO.PHS. TI NAL. EPS. S. C. | ć | | S DECEMBER ON A CHIESCE O DOOF TEE. | 7.41 | 8 |
| C IF NASTARI = 2. 46 GIN FROM A PROFILE ON INTEL: C IF NADAN = 1. FLAT FLAME BURNER AT PH = 0. C IF NADAN = 1. SPECIFY THE INCOMING FLUID VELUCITY(CM/SEC). C IF NTAN = 1. THE SHORT VERSION UF IS USEU. C IF NTRAN = 2. A LONG VERSION UF IS USEU. REAGIS-A30.PHO-PHS-FINAL EFS-SA-C REAGIS-A30.PHO-PHS-FINAL EFS-SA-C REAGIS-A30.PHO-PHS-FINAL EFS-SA-C ANTEINAL = 1PEIZ-4.) WHITE 134-80 INFRAN-INTNHURNAR-ELS-PIRE = 1PEIZ-4-5X. THNHURN = .14. C HATTINAL = 1PEIZ-4.) WHITE 134-90 INSTART-WINTNHURNAR-ELS-PIRE-SA-SA-CH-INT = .14.5X. THNHURN = .14. C HAMAI(LIOX SHEPS = .1PEIZ-4.) WHITE 134-95 INTRAN-IPH INT C THAN IS THE PAXIMUM HUN TIME ALLUM HEADIS-A31 NGTAN-IPH INT C THAN IS THE PAXIMUM HUN TIME ALLUM HEADIS-A37 INCH-FC C THAN IS THE PAXIMUM HUN TIME ALLUM WHITE 134-99 INCH-FC C THAN IS THE 134-99 INCH-FC C THAN IS THE PAXIMUM HUN TIME ALLUM C THAN IS THE PAXIMUM HUN TIME ALLUM WHITE 134-99 INCH-FC C THAN IS THE 134-95 IN | ř | - | TOTAL STORY TOTAL STORY TO THE | 171 | |
| C IF NHURN = 0, UNBOUNDED FLAME. C IF NHURN = 1, FLAT FLAME BURNER AT PH = 0, C IF NTAN = 1, THE SHORT VERSION UF 1 IS USEU. C IF NTAN = 2, A LONG VERSION UF 1 IS USEU. C IF NTAN = 2, A LONG VERSION UF 1 IS USEU. KEAD(5,430) NATATIONIN', NHURN, FLUSP A 37 FUHAT (114,4) PE12,4) WHITE (3,440) PHO,PHS, IF INAL ARD FOUNAT (110x SHEPE) = 1, PE12,4,5x,4,4HD,FD,FD WHITE (3,440) PHO,PHS, IF INAL ARD FOUNAT (110x SHEPE) = 1, PE12,4,5x,4,4HD,FD C DHAM I (110x SHEPE) = 1, PE12,4,5x,4HD,FD C TANA IS THE PALIMUM YUN TIME ALLUMIN. C TANA IS THE PALIMUM YUN TIME ALLUMIN. C TANA IS THE PALIMUM YUN TIME ALLUMIN. C TANA IS THE PALIMUM X = 1,4,5x,4HD,FD C TANA IS THE PALIMUM YUN TIME ALLUMIN. C TANA IS THE PALIMUM YUN TIME ALLUMIN. C TOWAT (1,10x SHED2,4) WHITE (3,495) NRAMA = 1,4,5x,4HD,FD C TOMAT (1,4) PE12,4) WHITE (3,495) NRAMA = 1,4,5x,4HC = 1,4,6,4/) C TOMAT (1,4) PE12,4) WHITE (3,495) NRAMA = 1,4,5x,4HC = 1,4,6,4/) C TOMAT (1,4) PE12,4) WHITE (3,495) NRAMA = 1,4,5x,4HC = 1,4,6,4/) C TOMAT (1,4) PE12,4/) WHITE (3,495) NRAMA = 1,4,5x,4HC = 1,4,6,4/) C TOMAT (1,4) PE12,4/) WHITE (3,495) NRAMA = 1,4,5x,4HC = 1,4,6,4/) C TOMAT (1,4) PE12,4/) WHITE (3,495) NRAMA = 1,4,5x,4HC = 1,4,6,4/) C TOMAT (1,4) PE12,4/) C TOMAT (1 | | 4 | 2. REGIN FROM A PROFILE ON TAPE !. | 2 4 | 36 |
| C IF NBURN = 10 FLAT FLAME BURNER AT PH = 0. C IF NURURN = 11 SPECIFY THE INCOMING FLUID VELUCITY (CM/SEC). C IF NTHAN = 2. A LONG VEHSION OF 15 USEU. C IF NTHAN = 2. A LONG VEHSION 15 USEU. HADISA 430 PHO-PHO-11 INAL +PS.5-5-C RADISA 430 PHO-PHO-11 INAL +PS.5-C RADISA 430 PHO-PHO-11 INAL +PP.10 IN +PP.10 | | NGUHN 31 | • UNBOUNDED FLAME. | ZIGE | æ |
| C IF NEURN = 1, SPECIFY THE INCOMING FLUID VELUCITY (CM/SEC). C IF NEURN = 1, THE SHORT VERSION OF 1 IS USEU. C IF NEURN = 2, A LONG VEHSION 15 USEU. READ(5,432) NSTART.NIVALEESSSTC READ(5,432) NSTART.NIVALEESSSTC READ(5,432) NSTART.NIVALEESSSTC READ(1,41) PEIZ.4, WHITE (3,440) PHO.PHS.IF INAL **HITE (3,440) PHO.PHS.IF INAL **HITE (3,440) PHO.PHS.IF INAL **HITE (3,440) PHO.PHS.IF INAL **HITE (3,440) NSTART.NIVINIVALEESS **90 FUHMAIT(1/10x.5HFPS = 1) PEIZ.4, **PEIZ.4, | | 15 AILLION | THE AT 61 AMP BILDNER AT 5H H O. | ZIV | 36 |
| C IF NUMBAN = 1, SPECIFF THE INCOMING TOLD VECULITIONS OF INTRAN = 1, THE SHORT VERSION OF P IS USEU. C IF NITAN = 2, A LONG VEHSION OF USEU. READ(5.432) NYTERT-10 INT.NBURN.FLUND 437 FOWMAT(2134.1PE12.4.) WHITE (34.41PE12.4.) | | וו אממאי | TO SECURITION AND THE PERSON AND THE | MATA | 3 |
| C IF NITAN = 1, THE SHORT VERSION OF P IS USEU. READ(5.4.30) PHO-PHS-FI INALEPS.S-Y-C READ(5.4.30) PHO-PHS-FI INALEPS.S-Y-C READ(5.4.32) NSTART*NINT*NINT*CLYSP 4.37 FURHAT(310x,5HPH0 = 1)PE12.4.5X*S-HPH5 = 1]PE12.4.5X*S ***HHTINAL = 1,PE12.4.7) WHITE (3.4.9.5) SEREC 4.60 FURHAT(7.10x,5HPH0 = 1)PE12.4.5X*S-HPH5 = 1]PE12.4.7) ***HITE (3.4.9.5) NSTART*NINT*NHURN*FLYSP 4.90 FURHAT(7.10x,5HPE12.4.7) ***LITE (3.4.9.5) NTRAN*TPW ITT 4.34 FOUNAT(4.10x,7HNTRAN = 1]4.5X*SHH1>-INT = 1]PE12.4.7) ***LITE (3.4.9.5) NTRAN*TPW ITT 4.34 FOUNAT(4.10x,7HNTRAN = 1]4.5X*SHH1>-INT = 1]PE12.4.7) ***C THAX IS THE WAXIMUM HUN TIME ALLUM**** ***ALTE (3.4.9.5) THAX ***ASTA (2.4.5.5) THAX ***ASTA (2.4.5.5) THAX ***ASTA (3.4.9.5) THAX ***ASTA (3.4.9.5) THAX ***ASTA (3.4.9.5) NCN*FC ***ASTA (4.4.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1 | | IF NEURN | C1111CM/3EC1 | 2 2 | 3 |
| C IF NTHAN = 2. A LONG VENSION IS USELLA READ(5.43P) PHO.PHS.TE INAL. EPS.S.Y.C READ(5.43P) NSTART NINT, NRUHNINFLLYC READ(5.43P) NSTART NINT, NRUHNINFLLYC WHITE (3.44P) PHO.PHS.TE INAL AND FOUNDAT(1/10x, SHPHO = 1) PE 12.4.5 X * CHPHS = 1) PE 12.4.5 X * CHPHS WHITE (3.44P) NSTART O'AL NHUHNINFLLYC AND FOUNDAT(1/10x, SHPHO = 1) PE 12.4.5 X * CHPHS COHMAT(1/10x, SHPHO = 1) PE 12.4.5 X * CHPHO COHMAT(1/10x, SHPHO = 1) PE 12.4.5 X * CHPHO COHMAT(1/10x, SHPHO = 1) PE 12.4.5 X * CHPHO COHMAT(1/10x, SHPHO = 1) PE 12.4.5 X * CHPHO COHMAT(1/10x, THOTHON = 1) PE 12.4.5 X * CHPHO COHMAT(1/10x, THOTHON = 1) PE 12.4.5 X * CHPHO COHMAT(1/10x, THOTHON = 1) PE 12.4.7 COHMAT(1/10x, THOTHON = 1) PE 12 | A.S | NA STEAN | • THE SHORT VERSION OF F IS USEU. | 214 | ָ נ |
| ### ################################## | | IF NTKAN | . A LONG VEHSION IS USED. | ZEAN | H. |
| ## ## ## ### ######################### | | UF AD I | CHANGE DISTRIBUTION OF THE STATE OF THE STAT | ZIVE | E E |
| ###################################### | | 50. 10. 00. 00. 00. 00. 00. 00. 00. 00. 0 | ON NET ACT AND A STATE OF THE CASE OF THE | ZIVE | D.X |
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| 4A0 FOHMAT(/10x.5HPHO =.1PE12.4.5X*hHPHS =.1PE12.4.5X* *** HHTFINAL =.1PE12.4.7 *** HHTFINAL =.1PE12.4.5X*hHPHS =.1PE12.4/) *** HHTFINAL =.1PE12.4.5X*hHPHNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNNN | 9 6 | #F11E (3+45 | | 2 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - | 7 (|
| * BHTFINAL = 1PE12.4/) WRITE (13.445) EPS.SREC 4R5 FUHMAI(1/10x.5HED2.4.5X*********************************** | | | | 2 4 | 26 |
| WHITE (3445) EPS.SKEC 4R5 FOHMAT(/10x.5HEPS = 1PE12.4.5X.M-SHEC = 1PE12.4/) 490 FOHMAT(/10x.6HEPS = 1PE12.4/) 490 FOHMAT(/10x.8HNSTART = 14.5X.MHURN = 14.5X.7HNHURN = 14.5X.7HHITE | | • | | ZIVE | 66 |
| ### ################################## | | | מבונסכי כחני. | ZIWM | 76 |
| ### ### ############################## | | | | 2 | 9 |
| ## ## ## ## ## ## ## ## ## ## ## ## ## | | | | 7.14.1 | |
| ### ### ############################## | 45 | 55°E) 311HF | 90) NSTART • WINT • NHURN • FLUSP | 7 4 | ę, |
| * 5x*7HFLDSP =*1PE12*4/) PEAD(5.4.34)NTRAN*TPP114T 4.34 FOWHAT114*-1PE12*-4/) # HITE (3.4.95)NTRAN*TPPINT 4.95 FUPMAT (11.0x*7HNTRAN =*14.5X*HHT***INT =*1PE12*4/) # HAD(5.4.35)TMAX 4.36 FUPMAT (11.0x*6HTMAX =*1PE12*4/) # HITE (3.4.97)TMAX 4.97 FUPMAT (1.0x*6HTMAX =*1PE12*4/) # HEAD(5.4.37)NCN*FC 4.37 FUPMAT (1.0x*6HTMAX =*1PE12*4/) # HEAD(5.4.37)NCN*FC 4.97 FUPMAT (1.0x*6HTMAX =*16.5X*6HFC =*1PE12*4/) # HITE (3.4.96)NCN*FC 4.98 FUPMAT (1.0x*5HNCN =*16.5X*6HFC =*1PE12*4/) # NOWD = 4 ********************************** | | _ | = . [4 . 5 X . 6 H :: [NT = . [4 . 5 X . 7 H N H U R N = . [4 | 2 | 76 |
| ## 12 | | | Neb 10F 12-47 | ZIVE | 96 |
| PEAD(546.34) NIRANIPEIRI 434 FOHMAT(14-) PEI2-4) WHIE (34.95) NIRANIPEIRI 495 FUHMAT(1/10x-7HNTHAN = 14.5x*HHT-~INT = 1Pt I2.4/) HEAD(5+6.35) THAX 436 FUHMAT(1PT UEIZ.4) WHITE (34.97) THAX 497 FUHMAT(1/10x-6HTMAX = 1PEIZ.4/) HEAD(5+6.37) NCN+FC 437 FUHMAT(1/10x-6HTMAX = 1PEIZ.4/) HEAD(5+6.37) NCN+FC 498 FUHMAT(1/10x-5HNCN = 16.5x*6HFC = 1PEIZ.4/) SMALL=1.0F-30 KOND=4 NCC=7 | | | | 2 4 | 00 |
| 434 FOHMATISA: PE 12.40) 436 #FISTER: 455 NTRAN; TPKINI 495 FUHMAI (1.0 X.) THINTAN = 1.14 5X * HHIV-VINI = 1.1Pt 12.47) C. TMAX IS THE MAXIMUM HUN TIME ALL UMF 436 FUHMAT (1.10 10.12.4) WHITE (3.497) THAX = 1.1Pt 12.47) HEAD (5.437) NCH * FC 497 FUHMAT (1.10 X * 6 HTMAX = 1.1Pt 12.47) HEAD (5.437) NCH * FC 497 FUHMAT (1.10 X * 6 HTMAX = 1.10 X * 6 HFC = 1.1Pt 12.47) SMALL = 1.0 F = 30 KON D = 4 KON | | | 4) N KAN- LTI | | |
| ## ITE (3-4-95) NTRAN, TPR INT 495 ## ITE (3-4-95) NTRAN, TPR INT 495 ## ITE PAXINUM HUN TIME ALL UNF ## A16 | | | • 1PE12•4) | 2 | 001 |
| 495 FURMAI(1/10%-7HNTRAN ==14.5%+HHT-~INT ==1PE L2.4/) C. TMAX IS THE MAXIMUM HUN TIME ALLUMP HEAD(5.43.5) TMAX 436 FURMAT (1PT UE 12.4) WHITE (3.49.7) TMAX 497 FURMAT (1/10%-6HTMAX ==1PE 12.4/) HEAD(5.43.7) NCN.FC 437 FURMAT (1.4.19F 12.4) WHITE (3.49.9) NCN.FC 498 FURMAT (1.4.19F 12.4) WHITE (3.49.9) NCN.FC 498 FURMAT (1.4.10%-5MNCN ==16.5%+6MFC ==1PE 12.4/) SMALL=1.0F = 30 KOND=4 NCC=7 | 001 | | OS)NTRAN-THINT | ZIAM | 101 |
| C TMAX 15 THE MAXIMUM FUN TIME ALLUM: HEAD (5.436) TMAX 436 FURMAT (1P10E12.4) WHITE (3.497) TMAX 497 FURMAT (/10x.6HTMAX =.1PE12.4/) HEAD (5.437) NCN+FC 437 FURMAT (/10x.6HNCN =.16.5x.4HFC =.1PE12.4/) MHITE (3.499) NCN+FC 498 FURMAT (/10x.6HNCN =.16.5x.4HFC =.1PE12.4/) SMALL=1.0F = 30 NOND=4 NOTE = 1.0F = 30 | • | | | Z | 102 |
| 436 FURMAT(1810E12.4) 436 FURMAT(1810E12.4) WHITE (3.497) IMAX 497 FURMAT(1810E12.4) WEAD(18.437) NCN+FC 437 FURMAT(18.19E12.4) WHITE (3.498) NCN+FC 498 FURMAT(10x.5HNCN = 16.5X.4MFC = 1PE12.4/) SMALL=1.0F-30 KUND=4 NCC-7 | | 2 | | Z | 103 |
| #Eabliseablingax 436 | | | The second secon | T W | 104 |
| 436 FURMAT(IPIUEI2.4) WHITE (3497)TMAA 497 FURMAT(/IOX.6HTMAX =. PEI2.4/) HEAU(15.427)NCN-FC 437 FURMAT(14.7PEI2.4) WHITE (3.499)NCN-FC 498 FURMAT(/IOX.5HNCN =. 6.5X.4HFC =. PEI2.4/) NODE4 NODE4 | | MC ACC CO & CA | 51 CARX | | |
| ## ITE (3-497) TMAA 497 FUHMAT (/10x-6HTMAX =-1PE12-4/) #EAD (5-437) NCH+FC 437 FUHMAT (14-1PE12-4) ## ITE (3-498) NCN+FC 498 FUHMAT (/10x-5HNCM =-16.5X-4MFC =-1PE12-4/) SMALL=1-0F-30 NUMD=4 NUC-2-7 | | | 10512.4) | 2 | COI. |
| 497 FURMATIC/10x6MTMAX = 1PEI2.4/) HEAU(5.437)NCN.FC 437 FURMATIC/4.37)NCN.FC 498 FURMATIC/4.30 KOND=4 NCC=7 10-10 | ر01 | | 971TMA | Z | 106 |
| ## ## ## ## ## ## ## ## ## ## ## ## ## | • | | 11 | MAIS | 107 |
| #EAU15-431 NCN-FC 437 FUMAT (14-1PE12-4) WHITE (13-49R) NCN-FC 49R FUMAT (10x-5HNCN =-16.5x,4MFC =-1PE12.4/) SMALL=1.0F-30 KUMD=4 NCC=7 | | | | EI WW | 108 |
| 437 F DHMAT(14, 1PE 12.4) WHITE (13.498) NCN-FC 49A F UHAT (/ 10 X 5 H N C N = • 16 • 5 X • 4 H F C = • 1 PE 1 Z • 4 Z) KOHD=4 NCC=7 TOTAL - 10 F = 10 F = 10 F = 10 F = 10 F E E E E E E E E E E E E E E E E E E | | | 7) NCHOF C | | |
| #HITE(3.498)NCN.FC 49R FUHMAT(/10X.5HNCN =.16.5X.4HFC =.1PE12.4/) SMALL=1.0F-30 KUHD=4 NCC-2 | | | • I PE 12-4) | 2 | A . |
| 49R FUHMATI(/10X+5HNCN =+16+5X+4HFC =+1PE1Z+4/) SMALL=1+0F=30 ROHD=4 NCC=7 | | | 99)NCM+FC | 2 4 ¥ | 110 |
| SMALL=1.05-30 KOND=4 NCC=7 | | | =+16.5X.4HFC | 2 4 X | 777 |
| | • | | | Z | 112 |
| | | In • I = Table | 201 | 2 4 4 | |
| c | | 7 ± 0 ± 0 × | | 774 | 7 . |
| c | | NECON. | | 2148 | 5 - |
| | | 0 0-171 | | | |

| | PROGRAM MAIN 76/76 OPT=1 HOUNU=+-#/ 11-ACE FIN 4.8+49H | 04/15/80 | 11.07.44 |
|------------|--|--|--|
| 115 | MF=22 PSH=PME_SS/RZ.05 TMSPH=TME/PHN TMSPH2=TMSPH/PHN | 2 2 2 2 2 7 4 4 4 4 4 2 2 2 2 2 | 118 |
| 02. | # Z 2 2 1 | ZZZZZZ ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ | 122 |
| | C ALL RZD = RH*RH*DIM/PHN. C RZD IS THE VALUE AT THE LEFT BOUNDAMY. C RZDM IS THE VALUE AT THE RIGHT END OF AN INTERVAL USED FOR C COMPUTING THE FLAME SPEED. C FUM NIYAM NIYAM = 1, THEY ARE THE SAME. | TTTTZZZ THEEKE TILII | 126 127 128 130 |
| 130 | NETISENTATION OF THE TRANSPORT OF THE APPROPRIATE NUMBALIZED VALUES FOR USE IN F (NIRAN=I). C FIND THE APPROPRIATE NUMBALIZED VALUES FOR USE IN F (NIRAN=I). C FIND THE APPROPRIATE NUMBALIZED VALUES FOR USE IN F (NIRAN=I). | N N N N N N N N N N N N N N N N N N N | 134 134 134 134 |
| 481 | 605 | T I I I I I I I I I I I I I I I I I I I | 136 137 139 140 |
| 140 | | M M M M M M M M M M M M M M M M M M M | 1441 1443 1443 1443 1443 1443 1443 1443 |
| 145 | | T T T T T T T T T T T T T T T T T T T | 2 |
| 150 | | E E E E E E E E E E E E E E E E E E E | 151 152 153 154 |
| ر51 | INDEX = I INDEX = I CALL HKPI (NINI + MCM + C + NVPIS) C UEFINE THE CENTER OF THE FLAME. KCEN = MCD \ MCD | T T T T T T T T T T T T T T T T T T T | 156 157 158 159 |
| 160 | HITE (3.573) KCEN.VCEN 573 FUNHAT (/10x.6HKCEN = 16.5X.6HVCr.: = 1PE12.4/) C INITIAL VALUE FOR THE SPEED OF THE URIGIN (MASS FLOW). IF (NSTART.EQ.2) REAU (1.255) SPEED!! IF (NSTART.EQ.2) HRITH (3.557) SPEED!! | Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z | 162 164 164 164 164 164 |
| 165 | IF (NSTART.FQ.1) SPEE.UU=0.0 ASP=SPEE)0 IF (NPUPN.EG.0.0)(4) 10 559 FWEERU=FLUSE | ZZZZZ ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ | 2000 |
| 170 | SPECIO=+M=TMSPH SPN1=SPECIO | MAN No no | 172 |

| | ASTRICTED O | | 2 2 | 176 |
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| | | | 2 4 | 7. |
| 1.1 | SOCIATION ENDEDERING ENDED 2-67) | 10612.47 | Z W | 176 |
| 671 | | | | |
| | CSA FUKBALLIFFIA D | | | - 1 |
| | + I HSECONG (CP.) | 41114 | 2 2 | E. (|
| | ל ל | | 2 4 5 | * : |
| | CALL POECOL (10, 1001) | CALL PDECOL (10+1001+D1+PHHKP1+EPS+NIN++AURUHUCL+NPDF+MF+ | Z 4 5 | 2 . |
| 347 | * INDEX * MODEX * INDEX * SMECI | EC | 2 4 1 | 18 |
| | 1F (INDEX.NE.0) 60 10 70 | • | 2 | 261 |
| | GT=SECOND (CP) | | Z | E H I |
| | H1=61=F1 | | Z | 144 |
| | IF (HT.61 . TMAX) TF INAL = TOUT | 1001 | Z V | 145 |
| 145 | WRITE (3+30) TOUT+DIUSE | DANSTEPS | Z | 196 |
| • | 30 FUHMAT (//10X+3HT ++1) | E12.4.44.4.1.7 = 1 Pt 12.4.4x. | MAN | 187 |
| | • | | Z A | 24.0 |
| | TOTAL STATE OF THE | | MAIN | 041 |
| | COLOR DE L'ACTION | (/ al - iii - NA7 - x3 - x - ii | NA TAI | 007 |
| | | | 7 4 7 | 2 2 |
| <u> </u> | ANTICIPATION TIME 100 1 / 2 / 2 | 17 7 7 1301 - 30 | N V V V | 101 |
| | | CONTRACTOR OF THE CONTRACTOR O | 2147 | |
| | THE DE REAL WORLD | | 2143 | 104 |
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| | UU 35 K=I+NPUEM | | Z . | 66 I |
| | | | 2 4 | 500 |
| 200 | 37 FURMAT (/10X+A10/) | | Z | 102 |
| | WHITE (3+39) (U | 1.NVPTS+NSK-T) | 2 3 | 202 |
| | 39 FORMAT (1P10E12.4) | | 2 : | 503 |
| | | | 2 3 | 505 |
| | #R17E (3+37) LG (NFUE) | | 2 : | 502 |
| ح ۵5 | WK17E (3,39) (UN(1),111 | *NVP1S*NSK1P1 | 2 : | \$ 1 2 2 |
| | #FITE (3,37) LB (NPDE P) | | 2 . | 207 |
| | | CHI XSCOPI CAN AND CONTRACTOR OF THE CONTRACTOR | 2 | Z07 |
| | 65 CONTINUE | | Z | 506 |
| | CALL FLSP (NPOE , TOUT . I | CALL FLSP (NPOE, TOUT, TPRINT, IF INAL, NVP IS, NCP IS, | 2 4 | 012 |
| ء م ر | * PHO*KCEN*FSP*UPH*CUF! | | Z | 211 |
| | 443 FORMATI/5X,8HSPEEUU = | • PE 2.4.6 / 4 + 4 + 4 + 4 2 - 4 1 2 4 / 1 | Z | 212 |
| | IF (TOUT "GE "TPRINT) TPR | INT=TPHINT+IFINAL/5.0 | 2 4 1 | 213 |
| | IF (NHURN.E0.0) GU TO 100 | 00 | 2 d d | 214 |
| | | | Z V | 215 |
| 215 | 610 (U)f (1)=U(1,1)-UPH(1) *P2D(1)/FM | 720(J)/FM | Z | 216 |
| | UUF (NPDE)=1.0 | | ZI VM | 217 |
| | | | 7 7 7 7 | 228 |
| | 612 ULF (NPDE) = UDF (NPDE) = UDF (J) | JF () | Z 41 | 612 |
| | WHITE (3,615) (UDF (L), L=1,NPDE) | | Z V | 979 |
| 055 | 615 FUHMAT (72X+29HSPECIES | | Z | ر ې |
| | | USTING THE CHIGIN SPEED AND CENTRING | Z | 227 |
| | Ĭ | | Z W | 223 |
| | 100 DO 110 K=1.NVPTS | | | 9// |
| | スナルス・ | | 2 d d | 552 |
| 225 | UMAX=AMAX] (U(KCEN+K) +U(KCEN+KP)) | J(RCE'N+RF)) | | 226 |
| | UMIN=AMIN] (U(KCE40K) •U(KCFN•KF)) | U(KCFN•KF)) | 7 T V W | 127 |
| | IF (UMAX.GT.VCEN.AND.UMIN.LT.VCE.)) KS=K | MIN.LT.VCE.JKS*K | 2.4 | 400 |
| | | | | |

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| , • | | PROGRAM MAIN | IAIN 76/76 OPT=1 MOUND=+-#/ IMACE FIN 4.8+49M | 04/15/80 | 11.07.44 | PAGE |
|------------|-------|--------------|--|--|---|------|
| | 630 | 115 | | 2222 4422 1121 | 230 231 232 233 | |
| | 235 | 447 | | ZZZZZ: HHHHH HHHHH HHHHH | 235 235 237 238 | |
| | 240 | | US=0.0 IF (SPEEDO.GT.0.0) SPEEDO=0.0 IF (SPEEDO.GT.0.0.0) SPEEDO+DS INC=TFINAL/100.0 TULD=TOUT | 2 | 5 | |
| . • | 542 | | UPH=PHNEW-PHCT UT=TOUT-10LO PHOLD=PHNEW-SPEEDO*U1 HSP=0.0 | 7222 4444 1111 | | |
| | 250 | 150 | ASPER SPN1: GO TO SPEEC | 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 | \$ \$ 5 \$ 5 \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ | |
| 45 | | 7.4 | SPU] = (PHNE) FM = - SPN] / 1 F SP = FM / RHC BH I TE (3 + 6 1 | ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ | 25.55 | |
| | 540 | ں ں | | | 255 255 255 255 255 255 255 255 255 255 | |
| . . | 245. | J | ME CENTER IS VEHY SMALL. MX=(PH3-PH2)/50.0 C=SGNT (DPHMX/DSG) C=AHAXI (TINC.TF INAL/100. C=AMINI (TINC.TF INAL/4.0) T=TOUT+TINC. | | 266 268 269 270 271 | |
| . . | £15 | - | If (TOUT.GT. TF INAL) TOUT=TF INAL If (TOLD.EO. TF INAL) 50 TO 201 UT=TOUT-TOLD UPH=PHAEW-PHGT SPNZ=2.0=SPN1-SPEUG-2.0*UPH/UT SPLEUN=0.5={SPN1-SPUG-2.0*UPH/UT SPLEUN=0.5={SPN1-SPUG-2.0*UPH/UT SPNZ=2.0=SPN1-SPUG-2.0*UPH/UT SPLEUN=0.5={SPN1-SPUG-2.0*UPH-UT SPNZ=2.0=SPN1-SPUG-2.0*UPH-UT SPNZ=2.0=SPN1-SPUG-2.0*UPH-UT SPNZ=2.0=SPN1-SPUG-2.0*UPH-UT SPNZ=2.0=SPNZ=2.0*UPH-UT SPNZ=2.0*UPH-UT SPNZ=2.0*UPH-U | 7777722 444444 111111 | 515 515 515 517 517 8 | |
| | 5 C#S | . v . ¶ | F (APS (UPH) | ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ | | |
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| 1 | 260 | TOOL # LOOT # LO | Z | 162 |
| 2 7 V | 976 | 15:1007 LE TETMAT (() TO 20 | MAIN | 262 |
| | | IF TOOLS FEET TIME CO. C. C. | MAIN | 293 |
| | 160 | CONTINUE CATA FILE DE | ZIVE | 546 |
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| Š | | 111 - 11 - 11 - 11 - 11 - 11 - 11 - 11 | ₹ NA Ex | 305 |
| | 917 | TOTAL | MAIN | 303 |
| | 3 | | NIAM | 304 |
| | | 32116 (2,20) (20x (1) •[H]3 (6N)) | MAIN | 305 |
| 100 | | TOTAL CANONIC CONTRACTOR CONTRACT | MAIA | 306 |
| 200 | | CALL VALUE (SECON (183) CO SOTON (183) NO SOTON (183) | MAIN | 307 |
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| | | #15 T C 2-2000 (1178-11) 1 1 1 1 1 1 1 1 1 | NAIA | 310 |
| 016 | 5,5 | | MAIN | 311 |
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| | | Figure 4 (100c 14 4) | MAIN | 314 |
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| 04/13/80 11.07. | N | ~ | 4 | \$ | £ | ~ | Œ | • | 07 | = | ~ | 13 | ~ | 15 | ÷ | - 1 | æ. | 61 | 20 | 77 | 25 | 23 | 54 | 25 | 26 | 27 | 28 | 90 |
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| 9/51/50 | 16. 1 | • | L | • | • | • | - | • | ų. | FVAL. F | • | L | L . | • | • | • | 4 | L | • | - | • | • | •• | • | • | 4 | 14 | مة |
| FIN 4.8.45 | E+NPDE+IC+KSKT+KSKR) | | さらアカヘ・1 からしゃ 1 レドル1 | | | (50) | | 014.64.4 | 1 | IE PUE IS RETURNED IN | | | | | | | | THN+R (KPDE) | | | | | | | | >V. | | |
| OPIEL HOUNDEA-#/ 1FACE | SUHROUTINE FITIME, PH. U. UPH. UPHZ. FVAL. NPDE, KPUE, IC. KSKI. KKR) | DIMENSION CONFOED OFFICIALLY OFFICE OF STATES OF THE CONFOED OF THE CONFOED OF THE CONFOED OFFICE OF THE CONFOED OF THE CONFOED OFFICE OF THE CONFOED OF THE CONFOED OFFICE OFFIC | COMMON/TABBEL/ASP = ESP = TPE = PHU = TMC = TMSPL = FMSPLE = TMSTF = TPF NT | COMMON/TARP/PRESS PUSK NPDEM | (20) 08 (20) | COMMON/TARCIVE COMM OND (20) ORCU (40) ORCUM (20) | COMMON/TARNI/CPINV.X/DF (20) | COMMENSATION / TANDA / | | AT FACH CALL THE TIME HATE OF CHANGE FOR ONE PUE IS RETURNED IN FVAL. | ******** | | PUEN | | CALL DAY SALE MUST SALE SIC SASKED | | IF (KPI)F FO MPDF) 60 TO 50 | F VAL #SP#UDA (KPDE) + K2UF (KPDE) * UPA / (KPDE) + THN*K (KPDE) | | UE) - TPENT | 900 | CPEXACT | | POF | -BIK) •H(K) | FVAL #SPOUDH (NDD) - 1+HL OUDHS (NDDL)+HTEMPOCH INV | | |
| 14/16 | SURROUTINE F | UIMENSION C | COMMON/TABA | COMMON/TARP | CIMENSTON H(20) .R(20) | COMMON/TARC | COMMON/TARN | COMMON/1 ARD | | AT EACH CALL TO | | YN# 1.0 | CO TO KET INPOFM | YNEYN-U(K) | CALL DICE.Y | SPI ASPACE SPACE | IF (KPI)F FO. | Honeds WA | EF THEN | UT=TPN+U(NPUE)-TPENT | DO 20 K=1.NPDE | H(K) HHO(K) +CPHX+UT | HTF MP = 0.0 | PO 25 KE S - NPDF | KIT MORRIF MO-R (K) *II (K) | FVAL SCHOULD | KF TINDN | |
| SUMMOUTINE F | | | | | | | | | | ٠ ت د | | • | | - | • | | Ť | 3 | | 20 | 1 | 97 | • | | × | j | | |
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| | | PTR::P150* (PtD**0) | | 2 |
| | | UU=UH (KPDE) -UC (KPDE) | | 5 * |
| | | U=UC (KDDE) +UD# ((SIN(PHM)) ++2) | | £ |
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| 2 | | VALUES FROM B PREVIOUS MON. | | 7 (|
| | | MEAN (1.65) PHCTO | | 7 . |
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| | 52 | FORMAT (1.8) | 7 | 3 (|
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| 35 | | READ (1.65) (PHS (L) .L=1.NPS) | | <u>e</u> ; |
| | | 00 60 K=1.NPDE | 770 | 16 |
| | | PEAD(1.65) (UP(K·L)·L=1·NPS) | | <u>.</u> |
| | بي د د | DO NOT MANT ANY NEGATIVE CONCENTRATIONS. | | 36 |
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| 3 | | IF (UP (K+L), GE.0.0) 6U TO SH | LINIO | 7 |
| | | LH=L-1 | | 25 |
| | | LP=L+1 | LINIO | £ 3 |
| | | UP (K+L) =0.5+ (UP (K+LM) + UP (K+LM)) | | 3 3 |
| | S.A. | CONTINUE | 11210 | 45 |
| 42 | | CONTINUE | | \$3 |
| | 65 | FURMAT(IPRE14.6) | | ۲.5 |
| | | IF (NRURN, FQ. 1) 60 TO 75 | LINIO | 6 0 |
| | 2 | CENTER THE FLAME. | | 04 |
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| • | SUMPOUTINE LINIT | TINI | 76/76 OPT=1 ROUND=+=#/ 1-ACE | FIN 4.4.4696 | 04/15/60 | 11.07.44 | PAGE |
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| | | C UETERMIN | MINE THE NEW VALUES HY INTERPOLATION. | | UINIT | 89 | |
| | | ¥ 001 | .~ | | UINI | 9 | |
| 40 | | - | (PH.61.PH0)60 TO 102 | | UINI | 19 | |
| | | 2 | :UC (KPDE) | | C1811 | 29 | |
| | | Ī | TUFN | | UINII | 63 | |
| | | 102 I | (PH.61.PHS(2))50 10 104 | | LINIO | 3 | |
| | | a . | : (bH-hd) (0Hd-Hd) | | UINII | 92 | |
| ć, | | Þ | 1)C (KPDE) +P* (UF (KFUL+2) -UC (KFUF)) | | LINIO | \$6 | |
| | | Ť | TURN | | LINIO | 29 | |
| | | I 04 I | (PH.LT.PHS(NPS)160 TO 104 | | LINIO | æç | |
| | | | (PHXR.NF.0.0) P= (PH-PHS(NPS) 1/ PHXR | | LINIO | 69 | |
| | | Ĩ | (PHXX.E0.0.0) P=0.0 | | LINIO | 20 | |
| 70 | | 2 | :UP (KPI)E .NPS) +P+ (UB (KPI)E) -UP (KPI)E +NPS)) | | LINIO | 7 | |
| | | Ĩ | TURN | | UINIT | 72 | |
| | | 108 C | SATINCE | | LINIO | 7.3 | |
| | | 110 1 | (PH.LE.PHS(K))60 TU 120 | | UIMII | 2 | |
| | | ± | K+1 | | UINIT | 75 | |
| 75 | | Š | 1 10 110 | | LINIO | 16 | |
| | | 120 K | | | LINIO | 11 | |
| | | 2 | (PHS(K)-PH)/(PHS(K)-PHS(KM)) | | UINI | 78 | |
| | | Ö | :UP (KPUE +K) +P+(UP (KPUE +K) +UP (KPI+E+KM) } | | UINIT | 62 | |
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| | | | COMMON/ FALL N/FHF F L * FFF F W * FFF L D * F | 7 | 61 |
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| | | | CONTROL OF THE PROPERTY OF THE | | |
| | 61 | | COMBON STAX | | 9 |
| | | | COMMON/TARCIVEL • CPM + + HO (20) • HZD (70) • RZDM (ZD) | ٦. ج | 1 |
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| | | | COMMON/TARMF/RMUV (1000) • DRHUV (1 == 0) | r S P | 61 |
| | | | CHANGING | 30.07 | 20 |
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| | 2. | | COMMON/I AHLB/CB(ZI) | ָ בּי | 7 |
| | | | CIMENSION KINT(20) * KINTI (20) * KI (70) | FLS P | 22 |
| | | | CONTROL OF T. COC. 31 COL. 30 C. | 3 | ζ. |
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| | | | UIMENSION X (401) + X (20) + D (20) | 7.5 | 2 |
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| | 1,2 | ,, | | FISP | 30 |
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| | | | CALL VALUES (PML + UL 1 + SC 1 CH + ND I M I + I + I + I + Z + W V N / | 7.7 | ÷ |
| 50 | | 128 | FUHMAT(/2x.13HRZO AT LEFT =.1Plue12.4/) | FLSP | \$ |
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| | | | OFFICE = 0 • 0 | 7 | 5 |
| | | | UPIZ (NFDE) # 0 * 0 | FLSP | 34 |
| | | | DO 12 JalaNPDEM | 7.55 | 35 |
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| | Š | ~ | UPH? (NPUE.) =UPH? (NPUE.) =UPH? (J.) | 1.50 | 37 |
| | | | IF (ABS (UPHINDDE)).LT.SMALL)UPH("PDE)=SMALL | FLSE | 38 |
| | | | RADE NEOF DEPORT (1901) ALPH (NPDE) | 55 | 2 |
| | | | 19 (19 (19 (19 (19 (19 (19 (19 (19 (19 (| 90 | . < |
| | | | | 10.0 | ; |
| |) . | | ANTIE (3+126) (OPH (C) + C=1+NPUE) + OC INPUE + C | 2 | , |
| | - | 176 | FURMAT(/2x+13HUPH AT LEFT =+1P10E12+4/) | FLSP | 24 |
| | | | #RITE (3+127) (UPH2(L)+L=1+NPDE)+OLT (NPDE+3) | FLSP | ę, |
| | | 127 | FORMATIONS AND THE THE THE TOTAL TOTAL | 35 | 77 |
| | 7 | · | N C C C C C C C C C C C C C C C C C C C | 0073 | · • |
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| | 55 | | []FH=FEVAL (K.) - PHVAL (K.) | FLSP | ş |
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| | SURWOUT INE | t FLSP | 16/76 | 0PT=1 | OPT=1 HOUND=+-4/ 1HACE | ± /• | ACE | FIN 4.8.49H | ¥ 5 4 | č | 04/15/80 | 11.07.44 | |
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| | | S. | UU 60 J=1.NPUE | | | | | | | | FLSP | 60 | |
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| | 9 | 001 | CONTINUE | 4 | | | | | | | F1 Se | 7 6 4 | |
| | | 2 | TOWNSHIP OF THE | <u>ء</u> - پ | | | | | | | 513 | 9 | |
| | | 1 | FINE ADDUCEDIATE VALUE AT NATU. | 791 187 | PMM TA | - | | | | | FLSP | 4 | |
| | | | CALL VALUES (PHVAL (N/10) *URT *SCTCH *NOTH! *1 *1 *2 ** URK) | VAL (NE | ID) ORT | •SCIC | 4.NU[M].1.1.2. | #CKK) | | | F 1.50 | 65 | |
| | 4 | | 1F (NTHAN-FO. 1) GO 10 11H | 60 10 | x - | | • | | | | FLSP | ş | |
| | È | | | 2 5 2 8 | F IS US | EU + SE | NEEU TO FIND | OUT WHAT THE | | VALIL | FLSP | 19 | |
| | | 5 | HZU IS AT THE APPROPRIATE POINT IN THE | APPROP | HIATE P | INIO | IN THE FLAME. | | | | FLSP | ę. E | |
| | | | | | | | | | | | FLSP | 69 | |
| | | | CALL F(TOUT+PHVAL (NMID)+URT(1+1)+URT(1+2)+URT(1+3)+FVAL | IVA! CNM | 1D) • URT | :::: | URT (1.4) +URT (| 11+31+FVA | ئ | | FLSP | 20 | |
| | 20 | • | * NPDF . 1 . 1C . 1 . 1) | _ | | | | | | | FLSP | 2 | |
| | | | 1ST#NCPTS*NPUE | | | | | | | | FLSP | 72 | |
| | | | 00 115 J=1.NP(| ž Ž | | | | | | | FLSP | 2 | |
| | | 115 | H-2DH(J) =-HHUV(IST+J)/URT(J+2) | 151+7) | VET C. | 2 | | | | | 45 Z | 2; | |
| | | æ : | UO 120 J=1.NPDEM | | | | | | | | 7.50 | ς; | |
| | 75 | 120 | U(J) #P20M(J) #UR1(J, A) - #R2U(J) *UC1(J, A) | 10. L | - 4200 | -K20(3) -0C1 (3•2) | 1000 | Ş | | | F . C.D | 6 [| |
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| | | | 0 (17FUE) = 0 + 0 | 7 | | | | | | | F1.50 | 2 0 | |
| | | | 1) (NDDE) = 1 (NDDE) = (1) |) - (C) | | | | | | | FLSP | ¥ 0 | |
| | ê | 124 | CONTINUE | | | | | | | | FLSP | 8) | |
| | | : | UU 130 J=1.NPDE | <u>u</u> | | | | | | | FLSP | 8 | |
| | | 130 | FLS (J)=FLS (J)+U(J) | 1000 | | | | | | | FLSP | K) | |
| | | 135 | CONTINUE | | | | | | | | FLSP | ţ | |
| | | | DIFF=UN(NMID)-UN(1) | ÇN.C. | | | | | | | FLSP | 35 | |
| | 45 | | IF (AMS (DIFF) .LE . SMALL) FLS (NPUE) = 0.0 | E . SMAL | L)FLS(N | PDE)=0 | 0.0 | | | | FLSP | Ç I | |
| | | | IF (ABS (DIFF) .(| T. SMAL | LIFLSIN | PUE) =+ | LS (NPUE) / (KHO |)*O[FF) | | | FLS5 | 787 | |
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| | • | 76.7 | Edit 1 mot white (1,) of all eNP(if) | (1) 51. | dNo [* io | (H) | | | | | FLSP | 66 | |
| | | 152 | FURMAT (/2x - 13MFLAME SPEED = 1Plut 12.4//) | FLAME | SPEEU = | 10101 | 12.4///) | | | | FLSP | 45 | |
| | | 155 | CUNTINUE | ! | | | | | | | FLSP | 56 | |
| | 43 | | FSP=FLS (NP[)EM) | | | | | | | | FLSP | £ | |
| | | CFI | FIND THE X VALUES | | THE TR | APLZ | USING THE TRAPEZUIDAL MULE. | | | | FLSP | 26 | |
| | | | ₩](])=0°0 | | | | | | | | FLSP | 8 | |
| | | | X(1)=0.0 | | | | | | | | FLSP | 3 | |
| | | | 50 200 K=1.NVPTS | . J.S | | | | | | | r. Sp | 00 | |
| - | 201 | | TEU (NIPUE oK) OTPN | , Z | | | | | | | בר לב בר לב | 707 | |
| | | | TSSMEDNIN / WINFUE | ב ב ב | | | | | | | 1.37 | 201 | |
| | | 140 | VSCM=VSCM+IIC I-K1/=(1) | , | _ | | | | | | 45.19 | 9 0 | |
| | | 2 | PHEDSE/(TevSSM) | | • | | | | | | 9.11 | 507 | |
| - | 105 | | KINT (1) = 1.0/PH | • _ | | | | | | | FLSP | 901 | |
| • | | | IF (K.EQ. 1) 60 TO 140 | 0 140 | | | | | | | FLSP | 101 | |
| | | | KM#K-] | | | | | | | | FLSP | F0 = | |
| | | | DPH=PHVAL (K) -PHVAL (KM) | HVAL CR | 3 | | ; | | | | FLSP | 601 | |
| • | • | | #100+(11) 10 *2+(HIN] (1) +#171 (11) +0.11 | 5• (H]z | 13.00 | ======================================= |) •UP! | | | | rtsp : | 0 : | |
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| | | 5 | 1F (TOUT-L1, TPPINE) -0 10 250 | D-CINI | 10 250 | | | | | | # L | | |
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| | | 250 | CONT I NUE | ط ا ا | 67 |
| | | ت ت | MPUTE THE FLAME THICKNESS. | 4 C S P | 2 |
| | 200 | | TTAKHAMAKH (U(NDUF-NVTX) - U(NDUF-1)) | 4574 | 121 |
| | | | TELENBERN CHENESE ONVETS - CORDER - LO | ٦ ٦ | 1.72 |
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| | | | 1L=TMIN+D1 | dS 7 | 125 |
| | 251 | | 10 310 K=1.NVPTS | FL 5- | 126 |
| | | | 7 X X X X X X X X X X X X X X X X X X X | FLSP | 127 |
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| | | | XIT#XI+3 | ا د کا | 132 |
| | | | PL=(U(NPUE,KL)-TL)/(U(NPUE,KL)-U(1,KLP)) | FLSP | 133 |
| | | | PH= (U (NPDE •KH) - IH) / (U (NPDE •KH) -: / (1 •KHP)) | FLSP | 1.34 |
| | | | PHIL #PHVAL (KL) +FL * (PHVAL (KLP) -PHVAL (KL)) | FLSP | 135 |
| | i 15 | | DHINHDHVAL (KH) +DH* (THVAL (KH) -DF-24L (KH)) | FLSP | 136 |
| | | | X 3 3 3 X (X) + D(+ (X (X)) + X (X)) | FLSP | 137 |
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| | | | WPITE (3-314)PHIL, PHIH | dS 1 | 0 1 |
| | 140 | | PHCENHO-50 (PHL+PHR) | 7.5 | [*] |
| 5 | | | PHFFL=AMINI (PHIL+PHIH) | FLSP | 742 |
| 2 | | | PHFFV=AMAX1 (PHIL, PHIH) | FLSP | 143 |
| | | 314 | FUNNAT (/10x+23HFLAME FRONT FRUM HHI* #*1PE12.4.2x+ | FLSP | 144 |
| | | | • 9410 PHI • 11-17-4/ | FLSP | 145 |
| | 245 | | I X X X X X X X X X X X X X X X X X X X | 45.19 | 991 |
| | \ • | 410 | COMMATACATOR SOURCE AND FORM A STIDE 12-4-28- | 3 | 147 |
| | | | ************************************** | 57.5 | 9 7 1 |
| | | | | 1531 | |
| | | 6 | AND | |) (I |
| | ; | ٠. د | TOTAL A LONG THE CARL INTO THE STATE OF THE | | 0 |
| | 150 | | JF (TOUT - LT TNAL) RETURN | ر د د | 151 |
| | | ± 3 ∪ | FATE OUTPUT FILE. | FLSP | 152 |
| | | | PRITE (9+1208) NPJE + NVPTS | FLSP | 153 |
| | | | #RITE (3+1208) NPDE+NVFTS | FLSP | 124 |
| | | 1203 | FOUMAT(514) | FLSP | 155 |
| | 155 | | UU 1215 K=1.NPUŁ | FLSP | 156 |
| | | | ##ITF(9+1212)LH(K)+%(K)+MD(K)+MZ=(K) | FLSP | 151 |
| | | | #KITE (0+1212)LB(K)+*(K)+*(K)+KO(K)+K/ (K) | ر د د د | 1 58 |
| | | 721 | FOHMAT(A10.1P3E15.4) | r Sp | 159 |
| | | 1215 | CONTINUE | r Sp | 20 |
| | 150 | | LHT=10HT | 45 J | |
| | | | WHITE (9+12)2)LH | ر ا ا | 767 |
| | | | #KITE (3.1.2) Z) LHT | FL SP | 143 |
| | | | WHITE (9.1210) TOUT | dS] | 164 |
| | | | WHITE (3:1210) TOU! | FLSP | 145 |
| | 16 5 | | FF TE (9-1210) ASP-HSF-TPN-PHR-IM. | ₹ 1 | <u>,</u> |
| | | | EVITE (3.1210) AST. HYP. TEN. PHIL. IN. | و ا ا | 101 101 |
| | | | Z717F (9.12101012F 5%-7%) | ر د د | # · |
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| | 1 | | #HITE (3-1210) CPMA-HL-THENT | <u>ج</u> ا | 0 7 |
| | 170 | | ## [16 (3+12)(0) PW6 54+124 | 3-1 | 121 |
| | | 1210 | FOUNDI (IPAFIA) | ر ا ا | 172 |

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| SUBROUTINE FLSP | | 76/76 OPIEI MOUNDESSEY IFACE | 27.5.5 NI 4 | 04/12/40 | 04/13/80 11:0/.44 | Y ACT |
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| 175 1200 | UU 1200 K=1+N CALL VALUES(P WHITE (9+1210) * (UNT (L+2)+L= CUNTINUE HEIURN | DO 1200 R=1.4NPTS | ************************************** | 777777 78877 7887 | 173 175 175 178 179 | |

| | | SUMMOUT INE | RNUHY | 14/16 | ()PT=1 | HOUNT | 0PT=1 +0UND=+-+/ 1-ACE | | F TN 4.8+49F | 1674 | 04/15/80 | 11.07.44 | |
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| | | | C AND | HIRD. PP. 762.763. | 52.763. | | | | | | FNCO | Œ | |
| | | | | CUMMON/TAHCT/NL +CPMX+HO(20)+HZU(/0)+HZUM(20) | ANL OCPM | 3 0H 0 K | 20) ** 2U (/ 0) • | 42174 (20) | | | HALINA | o | |
| | | | - | COMMON/TARME/HHUV (1600) • DRHUV (1000) | 10 AUM3/ | 0000 | DRHUV (1000) | | | | HNONA | 10 | |
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| | | | | COMMON/TAHCH/02M | ₩ZQ/ | | | | | | HNDKY | 3 | |
| | | | | COMMON/TAHV/PHVAL (461)+UN(461)+U1(20+401)+UC(20)+UH(20)+#(20) | ۲۳۷۸۲ (۴۱ | 5111 | 1(401) +11 (50 | 4011 • UC (, | 20) 1UH (2 | 02)**(0 | HNORY | 15 | |
| | 51 | _ | | U0 5 1=1 NPDE | ادا | | | | | | HNUKY | <u>ب</u> | |
| | | | | 0.0=(1)1050 | | | | | | | HNORY | 1.1 | |
| | | | | DHOU(1)=0.0 | | | | | | | BNOKY | 81 | |
| | | | 5 | UHDUPH(1)=0.0 | 6 | | | | | | HNURY | <u>6</u> | |
| | | | | IF (PH.GT.PHL) | 00 10 | 50 | | | | | HUNH | 50 | |
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| 54 | ť, | _ | | FHACTIONS AT THE COLD HOUNDARY. | 5 COLU 2 | TONOOR | | | | | ¥N()¥ | 9 | |
| 1 | | | ~ | IF INTRANGED. | 02 09(1 | 12 | | | | | ENDRY | 27 | |
| | | | | FIND HZD AT THE LEFT HOUNDARY | LEFT H | DUNDAR | ۲. | | | | HNCKY | 2,8 8,2 | |
| | | | - | DO A JELYNPDEM | Σ | | | | | | HUNH | ٤ | |
| | | | | JF (ABS (UPH (J)) . LT. SMALL) UPH (J) = SMALL | 1) . LT. St | MALLIL | JPH(J)=5MALL | | | | HNOHA | 30 | |
| | 36 | | x | K/D(.) =-EMIV | Hdn/ (T) | 5 | | | | | BNORY | 33 | |
| | , | | 2 | CONTINUE | | • | | | | | HNUKY | 32 | |
| | | | | DENTI (NOUE) = 1 - 0 | 5 | | | | | | HADRY | 2 | |
| | | | 2 | DO 20 I=1 *NDDEN | N L | | | | | | HUDHA | 7 | |
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| | 2 | | 5 | 040(04(1) == 800(1) VEM | 43/11/14 | 5 | | | | | BNDRY | <u> </u> | |
| | 2 | | 4 | THE MACK FIRST FRACTION FO ROES OF HAVE THE CORRECT VALUE. | FUACT. | TON FE | H TON STORY | AVF THE C | A TOTAK | AI UF. | BNOKY | ~~ | |
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| | 9 | | | DO 25 JalaNPIDEM |)E.M | • | | | | | HONG | - | |
| | | | | EP=U(1) -420(1) +UP+(1) VFM | J) #(Ib# (r | Z / Y X | | | | | BNORY | 24 | |
| | | | ĸ | DZDT (J) = (UC (J) -EP) *UZM | リートドリ・ し | W) | | | | | RNORK | £3 | |
| | | | _ | HE TURN | | | | | | | ANC)¥ | 3 | |
| | | | | 100 30 J=1,NPDE | Æ | | | | | | HUNH | 45 | |
| • | ζ* | | 30 | UHDUPH(J)=1.0 | | | | | | | HAURY | ę. | |
| | | | - | RF TURN | | | | | | | HUNH | 47 | |
| | | | | EM | | | | | | | HACINH | X X | |
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PACF

| | | SUHROUTINE BKPT (NINI+NCN+FC+NVPI>) | TAXT | ~ |
|--|---|--|--|---------------|
| COMMON/TAIRN/PAWAL (**101) COMMON/TAIRN/PAWAL (**101) COMMON/TAIRN/PAWAL (**101) COMMON/TAIRN/PAWAL (**101) COMMON/TAIRN/PAWAL (**101) COMMON/TAIRN/PAWAL (**101) **100000000000000000000000000000 | | COMMON/ENDFT/PH0+PH3 | IXI | m |
| COMMONTALY PRINCIPLE AND | | COMMON/TAURK/PRUKFT (31) | IXT. | 3 |
| COMMONYS TRAIT MAST INFORMANCE TO THE THE THE THE PRICE PHILLS PH | | COLMON/1814/PHVAL (401) • UN (401) • • (20) • UC (20) • UC (20) • E (20) | HKU | ıc. |
| | | | HAPT | 9 |
| ### ################################## | | TIM/N. COOK. NAME OF THE PROPERTY OF THE PROPE | Z Z | , |
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| ALPE 10.00=APP ALPE 10.00=APP P= (PHS_EPHO) / (FLUAT (MCR) * 2,0*ALP* (ALP**[-1,0) / (ALP*-1,0)) HE TRINITANCH) / 2 DU 11 K=1 MU MU=NINIT 11 = PHO DP= (DP ALP** 1 = PHHKPT (K) * 0)P MU=NINIT NCN MU=NINI | | ALF=2.0*ALGG10(+C)/*LUAI(NINI=N(-1) | 144 | <u>3</u> |
| | | ALT=10.0.** | HKPI | 15 |
| HKPT | | (\(\alpha\) | EK T | 91 |
| ###################################### | | D= (PMS-PHO) / (F) CB (N(N) +), CBALT + (A) T++ (-) ((ALT -) (D)) | TOXE | 17 |
| ### ################################## | | | 7 | <u> </u> |
| DUE 11 K = 1, NU NUE | | | | |
| Name | | | 2 2 2 | <u> </u> |
| ### ### ### ### ### ### ### ### ### ## | | NU=(NINI-NCN)/2 | HKPI | ٥2 |
| ###################################### | | DC 31 X = 3 , NO | HAPT | 2 |
| ### PICE PROPRIED PROPRED | | X X X X X X X X X X X X X X X X X X X | EKT. | 22 |
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| WE WE WE | - | | 1 X X | * |
| ## ## ## ## ## ## ## ## ## ## ## ## ## | | ML=NU+1 | BKP1 | 52 |
| UN P K ENL W W W W W W W W W | | NON-DNE | TYPI | Ş |
| ### ### ### ### ### ### ### ### ### ## | | O H Z | HEDT | 27 |
| ### ### ### ### ### ### ### ### ### ## | | | T C A C | - a |
| PHHKPT(KP)=PHHKPT(K)+()P NL=NU-1 NL=NU-1 NL=NU-1 NL=NU-1 NL=NU-1 NU=NIN-1 NU-NIN-1 NU-NI | | ON STATE OF | - 4 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | . (|
| NUMBER N | | | T X Y | 2 |
| ML=NU+1 NU=NINT NU=NIN | = | | TAT | <u>د</u> |
| ###################################### | | | HK F. | 31 |
| 00 13 K=NL.NU KP=K.1 KP=K.1 KP=K.1 KP=K.1 KP=K.1 KPT KPT KPT KPT KPT KPT KPT KP | | | TX | 2 |
| ###################################### | | THE THE PARTY CANAL | TOWN | |
| NEW | | | - 140 | 7 |
| UP=DP=ALP UP=DP=ALP UP=DP=ALP UPHKPT (KP)=PHHKPT (K) * UP UPHKPT (NINT+1)=PH5 CO TO 660 UPHKPT (NINT+1)=PH5 CO TO 660 UPHKPT (NINT+1)=PH5 UPHKPT (NINT+1)=PH0 UPHKPT (NINT+NCN) UPHKPT (NINT-NCN) UPHKPT (NINT-NCN | | X HX + | 7 . | * |
| ###################################### | | UV=0V+ALP | BKPT | 35 |
| HKPT (40 TO 660 LNEW STABLITED FLAME, HKPT LO TO 660 LNEW STABLITED FLAME, HKPT HKPT | | | エスフェ | 36 |
| HKPT CO TO 660 WALP WALP FME=PMO-0.3 = (PMS-PMU) HKPT HKPT HKPT HKPT HKPT HKPT ALP=H0.0 = 2.7 = (PMS-PMU) HKPT HKPT ALP=H0.0 = 2.7 = (PMS-PMU) HKPT ALP=H0.0 = 2.7 = (PMS-PMU) HKPT | • | | HKPI | 37 |
| ### STABILIZED FLAME. #### STABILIZED FLAME. #### STABILIZED FLAME. ################################### | | | | - 6 |
| ### STAMILIZED FLAME. #### PAGE STAMILIZED FLAME. #### PHT | | 3 | | 5 |
| HKPT ALP=PHO+00.3*(PHS-PHU) ALP=ALOGIO (FC)/FLUAT (NINT-NCN) ALP=ALOGIO (FC)/FLUAT (NINT-NCN) HKPT ALP=10.00*ALP BNFT B | ی | HAFF STABILIZED FLAME | #KPT | 6 |
| PH3=PH0+0.3*(PH5-PHU) ALP=ALOGIO (FC)/FLOAT (NINT-NCN) ALP=ALOGIO (FC)/FLOAT (NINT-NCN) ALP=ALOGIO (FC)/FLOAT (NINT-NCN) ALP=10.0**ALP BENPT B | Ē | | HKPT | 07 |
| ALP=ALOGIO (FC)/FLOAT (NINT-NCN) ALP=ALOGIO (FC)/FLOAT (NINT-NCN) ALP=ALOGIO (FC)/FLOAT (NINT-NCN) BENETT | • | | EXCH | |
| ALF=ALOGIO (FC)/FLOAT (NINT-NCN) ALF=ALOGIO (FC)/FLOAT (NINT-NCN) ALF=10.00*ALP 1=N10*-NCN P=(PH5-PH0)/(FLOAT (NCN)*ALP*(ALF**1-0)) PHHKPT(1)=PH0 PHHKPT(1)=PH0 PHKPT(1)=PH0 P | | | - Land | • |
| ALP=10.0004LP ALP=10.0004LP I=NINI-NCN PH(PT (I) = PH (I) PH (| | ALF=ALOGIO (FC)/FLUA! (NINI-NCN) | HXD | 24 |
| = N N N N N N N N N | | AL 7-110.0000000000000000000000000000000000 | BRPI | E 7 |
| PHRPT(1) = PHO) / (FLOAT (NCN) + ALP* (ALP*+1.0)) HKPT DO 653 K=1.NCN KP=K+1 PHHKPT(1) = PHO NU=NINT N | | 4 (2) | TX Z | 77 |
| PHENDS-FROM (CLOST CROW) FALT | | | | |
| DU 653 K=1.NCN WE 654 KF WE 654 KF WE 655 K=1.NCN WE 655 K | | 711 (7HV-7HD) / 41 (30N) + 41 (41 (41 (41 (41 (41 (41 (41 (41 (41 | ב ז ג | . |
| DO 653 K=1.NCN KP=K+1 HKPT NI=NCN+1 NU=NINT NU=NINT HKPT HK | | PHHKPT (1) = PHO | HKPT | <u>ئ</u> خ |
| NE=K+1 | | 50 653 Km - NCN | EKPI | 74 |
| PHEKPT (KP) = PHEKPT (K) + P NL = NC N + 1 NU = NI N | | | T C X C | a 4 |
| DHEND (KP) = PHEND (K) + P NU=N(N-1) NU=N(N-1) NU=N(N-1) HKP | ; | | | i (|
| NL=NCN+1 NU=NLN NU=NLN NU=NN NU=NN NU=NN NU=NN N N=N-1 N N N N N N N N N N N N N N N N N N | Ď | | 1440 | 7 1 |
| NU=NINI 1.0 A57 K=M. 4NU 4KPI 1.2 A57 K=M. 4NU 4KPI P=P+A.LP PHHKPI (K) +P CONTINUE HKPI HKPI HKPI HKPI HKPI HKPI | | N_=NC2.4. | - A | Š |
| 10 657 K=NL 64U | | | HKDI | 3 |
| KP=K+1 | | 10 457 K = M - 40 | EK 7. | 25 |
| P=P=LP PHHKPT(KP)=PHHKPT(K)+P CONTINUE CONTINUE HKPT HKPT HKPT HKPT | | 大子田大子 | HKP1 | , |
| CONTINUE CONTIN | | 1 4 4 1 1 1 7 | 1000 | |
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| CONTINUE HXPI ************************************ | Ĩ | | - | č. |
| HKP] | č | _ | TX. | 3.6 |
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| SUPPOUTINE HKPT | HKPT | 76/76 OPT=1 HOUND=+-*/ 1FACE | FIR 4.8444 | 04/12/80 | 04/15/80 11.07.44 | PAGF |
|-----------------|-------|---|------------|----------|-------------------|------|
| | | | | 1044 | 64 | |
| | C DEF | C DEFINE THE EVALUATION POINTS. | | HKPT | ب | |
| | • | アンアルボ | | HKPI | 61 | |
| ÷ | • | IVEISHINSPANINI -1 | | IXI | 5. | |
| . | | . IT K=1.NVPTS | | HKPT | 63 | |
| | • | V=1+(K-1)*NSP | | HKP1 | 49 | |
| | 1 21 | PAVAL (KV)=PHBKPT(K) | | HKPI | 65 | |
| | | 4Srp=NSP+1 | | HKUI | 99 | |
| , | _ | O 14 KENSPPONVPTS-USP | | HKPI | 47 | |
| • | - | dSN=X=W | | HKPI | 58 | |
| | _ | JF= (PHVAL (K) -PHVAL (KM))/FLOAT (NYF) | | TXX | 69 | |
| | _ | 10 19 J≈2.NSP | | EK 7 | 70 | |
| | _ | [-C+XX+L | | BKP1 | 7 | |
| 92 | _ | PHVAL (KT)=PHVAL (KM)+UP*FLOAT (J-1) | | BKP | 72 | |
| | 16 | CONTINUE | | HKP | 7.3 | |
| | | USK I P=NINT/10 | | HKPI | 74 | |
| | | IF (NSKIP of Tel) NSKIP=1 | | HKPI | 75 | |
| | | WHITE (3.39) (PHVAL (1) . [=] .NVP15:15K1P1 | | HKPI | 92 | |
| 2 | 39 | FOUMAT(1P)0E12.4) | | HKPT | 7. | |
| | | RETURN | | HXPI | 7.9 | |
| | | FIND | | | | |
| | | | | | | |

| SUHROUTINE | it RT | 76 | 16/76 | 0PT=1 | OP1=1 HOUND=+-#/ | / I-ACE | 1773.4 | 04/1/40 | 10.70.11 |
|--------------|----------|---------------------------------|--------------|-------------------|--------------------------------|--|-----------------------------|---------------|----------------|
| - | | SUBROUT INE | | C. *** | • NPUE • KPU | RT (U. YN. K. NPUE. KPUE. IC. KSKIP) | | 5 | ~ |
| • | | DIMENSION U(I) + K(I) | I) N | 1183 | | | | <u>.</u> | - |
| | | COMMON/TARP/PRESS.PSK,NPUEM | AHP/P | 2E5S+P5 | KINPUEN | | | <u>.</u> | J |
| | | COMMON | AHAR / | SPOHSE | · TPN · PHN | COMPONITARIANIAN LOST . LOST . TEN . THIS . THIS THIS THIS THIS TO THE THE | H2. TMSTP. TPENT | - · | ۰ |
| v | | LYNOWHOU | ABBY | I , KH , Y | • Y2 • Y3 • Y4 | CUMMON/1 ABRY/1 ERH FY1 FY2 FY3 F4 FY | 014.0 | 7 3 | ۲ ۴ |
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| 9.2 | J | HZ-UZ KINETICS. | ICS. | HAM | WAHNATZ. LLYUD'S | 0015. | | F | = |
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| 20 | | A=U(E | ` | 18.00 | | | | RT | 21 |
| | | /NX=6 X | 28.00 | | | | | ¥ | 25 |
| | | Y10=Y1+Y | 2+Y3+1 | 14+15+1 | Y10=Y1+Y2+Y3+Y4+Y5+Y6+Y7+Y8+Y4 | ~ | | <u>.</u> | 23 |
| | | Y11=Y6.0.4*Y7.6.0*YH.0.4*Y9 | .4*Y7. | 6.0*YH | +0.4eY9 | | | ₽. | 3 |
| | | KH=P SR/(T*Y10) | T*Y 10 | _ | | | | x : | % |
| ረ | | HHZ=KH*KH | ı | | | | | ¥; | 92 |
| | | 1F (KSKIP. GT. 1) GO TO 10 | 61.1 | 00 10 | 01 | | | ī : | 22 |
| | | HK (151+ | = ; | 2.2000 | 2.2000E +13*EXP(| | | ¥ 5 | E 6 |
| | | 5 | n 1 | | 7.3000E+13a6XP1 | | | ž 5 | 5.0 |
| ar. | | KK (151+ | 5 | 2 • C 0 0 0 C • 1 | Z+C000C+14*EXF1 | | | . C | 2 5 |
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| S | 1415 15 14F SFPT 23, 1917 VEHSION OF | | ⊕ ►₹0 |
| 2 - | C THIS PACKAGE WAS CONSTRUCTED SO AS TO CONFURM TO AS MANY ANSI-FURTHAN C PULLS AS WAS CONVIENTLY POSSIBLE. THE FORTHAN USED VIOLATES ANSI C STANDARDS IN THE TWO WAYS LISTED BELOW | POECOL POECOL POECOL | 2222 |
| 51 | C I. SUHSCRIPTS OF THE GENERAL FORM LOVI + V2 + V3 ARE USED C (POSSIALY IN A PERMUTED UNDER). WHERE C IS AN INTEGER CONSTANT C AND VI. V2. AND V3 ARE INTEGER "ARIABLES. | 2010 COL | 1657 |
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| ,,,,, | C DFDU WORK (1#11) | FPDE | WOWKING STORAGE USE JACORIAM MATRIX. | USED TO COMPUTE THE | POECOL | 575 576 |
| ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,, | C UF DUX | NPDE | WORKING STORAGE USE JACOBLAG MATRIX. | USED TO COMPUTE THE | POECOL | 27.4 27.8 24.9 |
| | C DFDUAX WORK (1%13) | ÄÜÄN | WORKING STORAGE USE JACOHIAN MATRIK. | USED TO COMPUTE THE | PUECOL PUECOL PUECOL | 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.0 |
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| | JLEF T IWURK | NCP1S | POINTERS TO BREAKPUINT SEQUENCE FOR GENERATION OF BASIS FUNCTION VALUES. | INT SEQUENCE FOR FUNCTION VALUES. | POECUL POECUL POECUL | 5.00 y |
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| CALL INITALIKOH-WORK (IM1) - WORK (IM1) - WORK (IM2) - POECOL | CALL INITAL (KOH+WORK (IWI)+ **ANKPI+WORK (IW2)+ **ANKPI (IW3)+ ** | POECOL PO | | C ROUNDARY CONDITIONS. THEN CHECK FOR SUFFICIENT STORAGE AGAIN. | FUE COL | 2 |
| CALL INITALIKOH-WORK[IW1].*#UHK[IW1].*#UKK[IW2].*#UKK[IW3]. *** **WORK[IW1].**I********************************** | CALL INITAL (KOH-WORK [1wf) * *AMKPT * *WORK [1wp] * WOECOL **** **AORK [1a17 * 1 * MOHK [1wh] * * MOHK [1wp] * * WOECOL [WSTOR = [wl] *** **NE*** **OF*** **OF**** **OF***** **OF**** **OF***** **OF***** **OF***** **OF***** **OF***** **OF***** **OF***** **OF****** **OF****** **OF****** **OF****** **OF******** | POECOL PO | | *************************************** | . PDECUL | 419 |
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| INSTORE WASTOR WA | WITCH WASAVE WA | POECOL PO | • | A TAXABLE TO TAXABLE T | 100000 | 723 |
| INSTOR = INT. * NEUTRIGIANCE. INSTOR = INT. * NEUTRIGIANCE. If (INSAVE .LT. INSTOR) 60 10 .35 C. IF INITIAL VALUES OF CMAX OTHER THA. THOSE SET HELOW ARE DESIDED. C. THEY SHOULD HE SET HEME. ALL CMAX(1) MISS HE POSITIVE. C. THAVING PHOPER VALUES OF CMAX FOR PROPULE. HE HOS SILVED IS AS POECUL CHAVING PHOPER VALUES OF CHAVING PHOPER. C. MEASUMED MELATIVE TO CMAX. If VALUES FOW DIMN ON DIMX. THE POECUL CHOUNDS ON AUSONT). OTHER THAN THOSE FELOW ARE DESIMED. THEY POECUL CHOUNDS ON AUSONT). OTHER THAN THOSE FELOW ARE DESIMED. THEY POECUL CHOUNDS ON AUSONTIES THE EMMON CONTROL. C. SHEC MODIFIES THE EMMON CUNTROL. C. SHEC MODIFIES THE EMMON CUNTROL. C. SHEC MODIFIES THE EMMON CUNTROL. C. SHEC MODIFIES THE PHONE CHITCHIUN IS USED FOR HOUSE OF COLUMN ANSOLUTE FROM CONTROL. C. SHEC MODIFIES THE EMMON (IMS) (WONK (IMS 11)). SHEC) DOF COLUMN ANSOLUTE FROM CHITCHIUN IS USED (IMS 11) = 1. POF COLUMN AND CHITCHIUN IS USED (IMS 11) = 1. POF COLUMN AND CHITCHIUN IS USED (IMS 11) = 1. POF COLUMN AND CHITCHIUN IS USED (IMS 11) = 1. POF COLUMN AND CHITCHIUN AND CHITCHIUN AND COLUMN AND CHITCHIUN AND CHITCH | INSIDE INTIAL VALUES OF CMAX OTHER THAN, THOSE SET MELOW ARE DESIDED. C. IF INITIAL VALUES OF CMAX OTHER THAN, THOSE SET MELOW ARE DESIDED. C. THEY SHOULD HE SET HEME, ALL CMAX(1) MUST HE POSITIVE, C. HAVING PHOPER VALUES OF CMAX FOR THE PROHILEM BEING SOLVED IS AS POECUL C. HAVING PHOPER VALUES OF CMAX FOR THE PROHILEM BEING SOLVED IS AS POECUL C. HAVING PHOPER VALUES OF CMAX FOR THE PROHILEM BEING SOLVED IS AS POECUL C. MASSULED FELATIVE TO CMAX. If VALUES FOR DIMN OR DIMX, THE POECUL C. SHOULD HE SET PELOW. PUBLICAL PU | POECOL PO | | | 1000 | J (|
| If (IMSAVE .LT. 1WS10P) 50 TO .335 C | If (IMSAVE .LT. IWSIOP) 50 TO .335 C | POECOL PO | | [WS10K = [W[| POLCOL | 52 |
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| C IF INITIAL VALUES OF CMAX OTHER THAN. THOSE SET HELOW ANE DESIDED. C THEY SHOULD HE SET HEME, ALL CMAX(1) MIST HE POSITIVE, C HAVING PHOPER VALUES OF CMAX FOR THE PROHILEM BEING SOLVED IS AS C IMPOUTANT AS CHOOSING EPS (SEE AHOUT). SINCE HEMONS ANE C MASULED MELATIVE TO CMAX. If VALUES FOW DIMN ON DIMN. THEY C SHOULD HE SET PELOW. PUPECOL PUPE | C IF INITIAL VALUES OF CMAX OTHER THAN, THOSE SET MELOW ARE DESIDED. C THEY SHOULD HE SET HEME, ALL CMAX(1) MUST HE POSITIVE, C HAVING PHOPER VALUES OF CMAX FOR THE PROPULEM BEING SOLVED IS AS C IMPOUTANT AS CHOOSING EPS (SEE AHUVE) & SINCE EMHUNS ANE C MEASURED MELATIVE TO CMAX. If VALUES FOR DIMN OR DIMX, THE C RUNDUS ON AUSCOT), OTHER THAN THOSE MELOW PUBLOL C SHOULD HE SET PELOW. C SHOULD HE SET PELOW. CC SHEC MODIFIES THE EMHUN CONTRUL. CC SHEC MODIFIES THE EMHUN CONTRUL. CC SHEC MODIFIES THE EMHUN CONTRUL. CC SHEC MODIFIES THE EMHUN (1905 (1 | POECOL PO | | | . PUFCUL | 7.55 |
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| CC SHECK MODIFIES THE EHHUM CONTRUL. CC AN AMSOLUTE FRROM CHITEMION IS USED FOR DUANTITES LESS THAN SMEC. PUECOL UD 50 1 = 1 *NE GH UU 50 1 = 1 *NE GH Il = 1 - 1 PUECOL *********************************** | C. SHE MODIFIES THE EHMUN CONTRUL. CC. SHE MODIFIES THE EHMUN CONTRUL. CC. AN AHSOLUTE FEROR CHITEMION IS USED FOR UDANITIES LESS THAN SPEC. 11 = 1 = 1 = 1 PRECOL 20 50 | PUECOL PUECOL PUECOL PUECOL PUECOL PUECOL PUECOL PUECOL PUECOL | | C SHOULD HE SET PELOW. | PDECUL | 732 |
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| | 1 | 1 | | | PINECOL | 7 7 |
| 1 | 1 | 10 50 1 = 1 MPE (N) MOPK (1 M = 1 MPE (N) MOPK (1 M = 1) = 1 MPE (N) MOPK (1 M = 1) = MOPK (1 MP = 1) MOPK (1 M = 1) = MOPK (1 MP = 1) MOPK (1 M = 1) = MOPK (1 MP = 1) MOPK (1 M = 1) = MOPK (1 MP = 1) MOPK (1 M = 1) = MOPK (1 MP = 1) MOPK (1 M = | , | | | |
| | | 11 = 1 - 1 PUP COL MUPR (1 MP+11)) • SREC) PUP COL MUPR (1 MP+11) = MUPR | ر ک | DO DO T T DO DO | 20.20. | 132 |
| | ###################################### | #OPK (IM4+11)=AMAX (AA5 (WOPK (IM5+11)) + SREC) PDF (OL POF (OL D POF (AB+11)) = NOFK (IM5+11) = NOFK (IM5+11) = POF (OL POF (OL D POF (AB+11)) = NOFK (IM5+11) = NOFK (AB+11) = NOFK (AB+ | | - t - 11 | 20.50 | 7.17 |
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| TO STORY THE MAN TO STORY THE STORY | 2 = NEDN PDECOL 1 = 10 PDECOL 01(= 01 PDECOL | PPF COL | | | 10.1 | |
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| SUPROUTINE | PDECOL 76/74 OPT=1 MOUND=+-4/ FMACE | F-N 4. 4.443 | 04/15/80 | 11.10.37 |
|------------|--|--------------------|--|--------------|
| | UTWN = ABS(DT) UTUSED = 0. EVSC = EPS | | POECOL POECOL POECOL | 743 |
| 745 | | | PUECUL | 745 |
| | USTART = 0 | | POECOL | 747 |
| | | | POECUL | 749 |
| | NOVE = DECONANT | | PUECUL | 750 |
| 750 | NHCUT = 0 | | PDECUL | 151 |
| | KFLAG = 0 | | PUECUL | 752 |
| | 1001P = 10 16 / 10 / 60 Toul 1 / 40 TO 360 | | Portor | 75.6 |
| | 60 DIMX = ABS(10UT-10UIF)*10. | | PDECOL | 755 |
| 755 | | | PDECOL | 756 |
| | | | PUFCUL | 157 |
| | /U DIMX = AMS(10D1=10U1P)=10. 1F ((1~10U1)=01C .6E. 0.) GO 10 340 | | PUECOL | 7.59 7.59 |
| | 60 TO 150 | | PUECOL | 140 |
| 740 | | | POECUL | 751 |
| | 60 IF ((1=1001)=01C .0E. 0.1 (90 10 500) | | POFCOL | 767 |
| | | | PDECOL | 164 |
| | | | PDECUL | 765 |
| 76.5 | 60 10 100 | | PDECOL | 756 |
| | · | | PUECUL | 767 |
| | 40 DTMX = DT | | PDECOL | 768 |
| | 100 IF ((T+DTC) .EQ. T) WHITE (LOUT-110) | | PDECUL | 769 |
| 7.7 | I C + OKWAT (JOH WARNING + DI = DI NEXI SIET.) | | PUECUL | 177 |
| 2 | C TAKE A TIME STEP BY CALLING THE INTO-HATCH. | | PDECOL | 772 |
| | | | PUECUL | 773 |
| | CALL STIFTRINEON TOUT . WORK (IMID) . WORK (IMA) . WORK (IMS) . WORK (IMB) | 145) .WORK ([W6) . | PUFCUL | 774 |
| į | • | - WORK - I WORK) | PDECOL | 775 |
| 212 | | | PUFCOL | o : |
| | KGO = 1 - KPLAG | | PUFCUL | 37.6 |
| | C KFLAG * D * 10 * 10 * 40 * 44 | | POECOL | 62.2 |
| | | | PDECUL | 740 |
| 240 | 120 CONTINUE | | POECOL | 743 |
| | (processes to proceed and the contract of the | / 1 | PDECOL | 742 |
| | | | POFCUL | 786 |
| | C THE MEIGHTS CMAX(1) AHE UPDATED. IF DIFFEHELL VALUES ARE DESIPED. | S AME DESIPED. | PUFCOL | 745 |
| 785 | | 46 TOO SMALL | PDECOL | 7.86 |
| | C FOR THE MACHINE PRECISION. | | PUECUL | 787 |
| | C. ANY DIMED TESTS OF CALCULATIONS THAT ADE WEINLINED AFTED EVENY | TED EVERY | POLICE PO | # C C |
| | C STEP SHOULD BE INSERTED MERE. | | PDECUL | 190 |
| 190 | | | PUECUL | ~ ? |
| | | A RE TURN. | PULCOL | 262 |
| | | JUNDON P | | 56/ |
| | | INTEGRATOR | 100 | 202 |
| 797 | | JES OF CARP | POFCEL | 52 |
| | | | PDECUL | 747 |
| | C IF INTERPOLATION IS NOT DESIMED. THE CALL TO INTERP SHOULD "" | SHOULD ''F | PUE COL | 407 |
| | C REMOVED AND CONTROL THANSFERNED TO STATEMENT SKID TISS | IEAD OF 350. | MOZGOL | 6 02 |

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| 110 TOWART (17.27) KERON TELED WITH FOREIGN AT 1 = 1.6 FO.01 110 TOWART (17.20) 10 TO 200 110 TOWART (17.20) 10 TO 200 111 F (AMCUT . EU. 10) 10 TO 200 111 F (AMCUT . EU. 10) 10 TO 200 112 F (AMCUT . EU. 10) 10 TO 200 113 F (AMCUT . EU. 10) 10 TO 200 114 F (AMCUT . EU. 10) 10 TO 200 115 F (AMCUT . EU. 10) 10 TO 200 116 F (AMCUT . EU. 10) 10 TO 200 117 F (AMCUT . EU. 10) 10 TO 340 118 F (AMCUT . EU. 10) 10 TO 340 119 F (AMM TICASO) T (AMCUT . EMCUT E WITH GIVEN INPUICAL) 110 F (AMM TICASO) T (AMM TICASO) T (AMCUT . EMCT EM THAN CAN HE HANGLE LOUT POECUL POECUL CO.01 TO 340 110 F (AMM TICASO) T (AMCUT . EMCUT E EMCT E EMCT . EMCCOL CO.01 TO 340 110 F (AMM TICASO) T (AMCUT . EMCT E EMCT . EMCT . EMCT . EMCCOL CO.01 TO 340 110 F (AMM TICASO) T (AMCUT . EMCT | | | 100 | 200 |
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| • 26H AND STEP WILL HE HETRIED//) JSTART = -1 GO TO 100 GO TO 100 CO WHITE (LOUT-210) PUECOL PUE | | 190 FORMAT (25H OT MAS NEEN PEOCCED, 10 -F.16+3+ | PDECOL | H35 |
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| 60 TO 340 C. 260 WRITE (LOUT-270) T PDE COL | | X S S S S S S S S S S S S S S S S S S S | Principal | 27.7 |
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| SUB | SUBROUTINE | PDECUL | 76/76 | | 1=1 | KOUND=+- | OPI=1 MOUND=+-*/ IMACE | LL. | T Z | N N | FIN 4.8.4478 | /40 | 04/15/40 | 11.10.37 | |
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| | • | } | | | | | | | | | | Q. | PUECUL | H59 | |
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| 0.40 | | 240 FO | 290 FORMATIC/28H STUGOLAH MATRIX ENLOUNTEREU. | I V | IGUL AL | H MATELY | T ENCHUN | TEMEU. | | | | <u>a</u> | PUECUL | £5. | |
| | | * | ř | ž. | HAHL | Y DUE TO |) STOWAGE | 35H PRUBAHLY DUE TO STUMBGE OVERWHITES//) | TES// | WH; TES//) | | • | 20E CUL | 462 | |
| | | ¥ | KFLAG = -4 | | | ! | ı | | | | | 3 | PDECOL | H63 | |
| | | 3 | 60 TO 340 | | | | | | | | | <u>a</u> | POECUL | 464 | |
| | • |)) |))) | | | | | | | | | a | POECUL | 865 | |
| 7,44 | | 300 mK | 100 WHITE (LOUI, 310) I. TOUT, DIC | .310) | 1.10 | UT.DIC | | | | | | 3 | PDECOL | 866 | |
| | | 310 FO | HMAT (//4 | ZI HS | EX = | NO 1- | IM IOHNI | 310 FURMAT (//45H INDEX = -1 ON INPUT WITH (1-10UT) *01 | 11 *01 | | .GE. 0./ | a . | PDECOL | 847 | |
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| H70 | | CA | CALL INTERP (TOUT, WORK (IM10) , NEUR . MORK (146)) | P (100 | T-WOR | K (1W10) | NEUTI- 30 | *** (1 46)) | | ? | | а. | PDECOL | 37.1 | |
| | | 2 | INDFX = -5 | | | | | | | | | 2 | POECUL | 872 | |
| | | ¥ | AF TURN | | | | | | | | | <u>.</u> | PUFCOL | 873 | |
| | • | ا | | | | | | | | | | <u>a</u> | PDFCOL | 918 | |
| | | 320 WR | WRITE (LOUT, 330) IEMID | .330) | ILMI | د | | | | | | ۵. | PDECUL | 875 | |
| ۲, | | 330 FO | FORMATI //24H ILLEGAL INPUT IN: 4 X= . 13//) | H | EGAL | INPUT. | HX + ZI. | 13// | | • | | <u>.</u> | PDECOL | 476 | |
| | | | INDEX = IFRID | 012 | · · | | | | | | | ۵. | PDECOL | H 7.7 | |
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| | - | ن | | | | | | | | | | <u>a</u> | PDECUL | H79 | |
| | | 335 WK | ATE GOUT. | 1988 | INST | UR. INSA | VE + 11 > TO | HIJSAVE | | VF. | | α. | POECOL | 990 | |
| C & | | 136 FO | HMAT (//2) | Z | SUFFI | CIENT S | TOWALL /2 | 336 FURMATILIZIN INSUFFICIENT STORAGY /24H WURN MUST | MUST | HN MUST B | BE OF LENGIM. | _ | PUECUL | 887 | |
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PAGF

DIAGNOSIS OF PROBLEM CARD NR. SEVERITY DETAILS

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ARRAY REFERENCE OUTSIDE DIMERSION HUUNUS.

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| COLUMN COLUMN CONTRACTOR COLUMN COLUM | C THE USE OF THE GAUSS-LEGENME POINTS IS PHUHIBITED FOR ALL CASES. C THE USE OF THE GAUSS-LEGENME POINTS IS PHUHIBITED FOR ALL CASES. C NUCKEY MAY CHANGE THIS AS DESIRED. L THE USEK MAY CHANGE THIS AS DESIRED. C COMPUTE THE COLLOCATION POINTS TO BE AT THE GAUSS-LEGENDRE POINTS IN C EACH PIECEMISE POLYNOMIAL SPACE SUBHIFTENAN HID IS SET TO C CONTAIN THE GAUSS-LEGENDRE POINTS FOUR THE STANDARD INTERVAL (-1.1). C CONTAIN THE GAUSS-LEGENDRE POINTS FOUR THE STANDARD INTERVAL (-1.1). LPTS = KOPD - 2 GO TO (10.20-30.40.50.60.70.80.50.100.110.120.130.140.150.170.170.1 C HHO(1) = 0. GO TO 190 20 WHO(2) = .57735069149626E-00 HHO(1) = .HU(3) HHO(1) = .HU(3) HHO(1) = .HU(3) HHO(1) = .HU(3) HHO(1) = .HU(4) GO TO 190 40 WHO(2) = .39998104.3584456E-00 HHO(2) = .3998104.3584456E-00 HHO(2) = .39469310105683E-00 HHO(2) = .49469310105683E-00 HHO(2) = .HU(4) HHO(1) = .HU(4) HHO(1) = .HU(3) HHO(1) = .HU(4) | | | COLPNI | 56 |
| C IF WARLANDER MOGAUS IN THE COMMUNIATION, 15 SET + CO. 1 ** C IF USE OF THE GAUSS-LEGENDRE POINTS IS PROUPUBLIED FOR ALL CASES. C NOVANUS IS CURRENTLY SET : E.O. 0 BY A JATA STATEMENT IN THE RLUCK DATA. COLPNI C THE USER MAY CHANGE THIS AS DESIRED. L THE STATEMENT IN THE RLUCK DATA. COLPNI C COMPUTE THE COLLOCATION POINTS TO BE AT THE GAUSS-LEGENDRE POINTS IN COLPNI C COMPUTE THE COLLOCATION POINTS TO BE AT THE GAUSS-LEGENDRE POINTS IN COLPNI C COMPUTE THE COLLOCATION POINTS FOW THE STANDARD INTERPAL (-1-1). COLPNI C CONTAIN THE GAUSS-LEGENDRE POINTS FOW THE STANDARD INTERPAL (-1-1). COLPNI C CONTAIN THE GAUSS-LEGENDRE POINTS FOW THE STANDARD INTERPAL (-1-1). COLPNI C CONTAIN THE GAUSS-LEGENDRE POINTS FOW THE STANDARD INTERPAL (-1-1). COLPNI C CONTAIN THE GAUSS-LEGENDRE POINTS FOW THE STANDARD INTERPAL (-1-1). COLPNI C TO 10 190 LO TO 190 LO | C If THE VARIABLE NOGAUS IN THE COMMON HLOCK /UVTION IS SET & LU. 1 - C THE USE OF THE GAUSS-LECANDER POINTS IS PROUNDITED FOR ALL CASES. C NOGAUS IS CUBRETULY \$ET & LO. 0 BY A .JAA STATEMENT IN THE RLOCK DATA. C THE USE W MAY CHANGE THIS AS DESIRED. C THE USE W MAY CHANGE THIS AS DESIRED. C THE USE W MAY CHANGE THIS AS DESIRED. C THE USE W MAY CHANGE THIS AS DESIRED. C THE USE WAS CHANGE THIS AS DESIRED. C COMPUTE THE COLLOCATION POINTS TO BE AT THE GAUSS-LEGENDRE POINTS IN C EACH PIECEMISE POLYNOWING SPACE SUBLIFFERMAL. THE AKKAY RHO IS SET TO C CONTAIN THE GAUSS-LEGENDRE POINTS FUN THE STANDARD INTERVAL (-1.1). C CONTAIN THE GAUSS-LEGENDRE POINTS FUN THE STANDARD INTERVAL (-1.1). C CONTAIN THE GAUSS-LEGENDRE POINTS FUN THE STANDARD (-1.1). C CONTAIN THE GAUSS-LEGENDRE POINTS FUN THE STANDARD (-1.1). C CONTAIN THE GAUSS-LEGENDRE POINTS FUN THE STANDARD (-1.1). C CONTAIN THE GAUSS-LEGENDRE POINTS FUN THE STANDARD (-1.1). C CONTAIN THE GAUSS-LEGENDRE POINTS FUN THE STANDARD (-1.1). C CONTAIN THE GAUSS-LEGENDRE POINTS FUN THE STANDARD (-1.1). C CONTAIN THE GAUSS-LEGENDRE POINTS FUN THE STANDARD (-1.1). C CONTAIN THE GAUSS-LEGENDRE POINTS FUN THIS SET TO THE CONTAIN THE GAUSS-LEGENDRE POINTS FUN THIS SET TO THE CONTAIN THE GAUSS-LEGENDRE POINTS FUN THIS SET THE GAUSS-LEGENDRE POINTS FUN THE GAUSS-LEGENDRE POINTS FUN THE GAUSS-LEGENDRE POINTS FUN THE GAUSS-LEGENDR | 3 5 6 6 6 6 6 7 6 7 | - | COLPNI | Ю |
| COUPPUT THE GAUSS-LECENDAR'S IS PAUMIPITED FOR ALL CASES. C NUCAUS IS CURRENTLY SET .ECO. 0 HY A .DATA STATEMENT IN THE RLOCK DATA. COLPNI C THE USER MAY CHANGE THIS AS DESIRED. C THE USER WAY CHANGE THIS AS DESIRED. IF I NCC .NE . 2 .DH. NOGAUS .E 1) 60 TO 200 C COMPUTE THE COLLOCATION POLITY SET & COLPNI C COMPUTE THE COLLOCATION POLITY SET & COLPNI C COMPUTE THE CAUSS-LECENDARE POINTS IN COLPNI C COMPUTE THE CAUSS-LECENDARE POINTS IN COLPNI C CONTAIN THE GAUSS-LECENDARE POINTS FOR THE STANDARD INTERVAL (-1-1). C CONTAIN THE GAUSS-LECENDARE POINTS FOUR THE STANDARD INTERVAL (-1-1). C CONTAIN THE GAUSS-LECENDARE POINTS FOUR THE STANDARD INTERVAL (-1-1). C COLPNI C CONTAIN THE GAUSS-LECENDARE POINTS IN COLPNI COLPNI C TO | C THE USE OF THE GAUSS-LEGENDATE POINTS IS PHONIBITED FOR ALL CASES. C NUCAUS IS CURRENTLY SET .EO. 0 BY A .UATA STATEMENT IN THE RLUCK DATA. C THE USER MAY CHANGE THIS AS DESIRED. C CHANGE THIS AS DESIRED. C CUNTAIN THE GAUSS-LEGENDRE POINTS TO BE AT THE GAUSS-LEGENDRE POINTS IN C EACH PIECEMISE POLYNOWINE PROTINTS TO BE AT THE STANDARD INTERVAL (-1-1). C CUNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD INTERVAL (-1-1). LPTS = KODD - Z GO TO (10.20.30.40.50.60.70.60.70.10.110.120.130.140.150.110.10.110. C CUNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD INTERVAL (-1-1). LPTS = KODD - Z GO TO 190 C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD INTERVAL (-1-1). LPTS = KODD - Z GO TO 190 C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD INTERVAL (-1-1). LPHO(1) = 0. CU TO 190 C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD INTERVAL (-1-1). C UTO 190 C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD INTERVAL (-1-1). C UTO 190 C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UTO 190 C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UTO 190 C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD INTERVAL (-1-1). C UTO 190 C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UTO 190 C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UTO 190 C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UNTAIN THE BUTCH THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UNTO 190 C UNTAIN THE GAUSS-LEGENDRE POINTS FUR THE STANDARD (-1-1). C UTO 190 C UNTAIN TH | HLUCK /UPTIUN/ 15 | | COLPNI | 5 6 |
| C COUNTY IS CURRENTLY SET *60.0 BY A .0474 STATEMENT IN THE RLUCK DATA. C THE USEK MAY CHANGE THIS AS DESIRED. L THE USEK MAY CHANGE THIS AS DESIRED. JF I NCC .NE. 2 .04* NOGAUS .L**, 1) 60 TU 200 C COMPUTE THE COLLCCATION POINTS TO BE AT THE GANGS-LEGENDRE POINTS IN COLPNI C CONTAIN THE GAUSS-LEGENDRE POINTS IN THE GAUSS-LEGENDRE POINTS IN COLPNI C CONTAIN THE GAUSS-LEGENDRE POINTS FOUR THE STANDARD INTERVAL (-1.1). LPTS = KOND - 2 ANOTINE TO TO 100 COLPNI COL | C NUGARS IS CURRENTLY SET .EO. O BY A JATA STATEMENT IN THE RLUCK DATA. C THE USER MAY CHANGE THIS AS DESIMED. L THE USER MAY CHANGE THIS AS DESIMED. L THE USER MAY CHANGE THIS AS DESIMED. L TOC. NE. 2 . OH. NOGAUS .E, I) GU TU 200 C CUMPUTE THE COLLOCATION POINTS TO BE AT THE GAUSS-LEGENDRE POINTS IN C CUMPUTE THE COLLOCATION POINTS TO BE AT THE GAUSS-LEGENDRE POINTS IN C CONTAIN THE GAUSS-LEGENUME POINTS FIM THE STANDARD INTERVAL (1-11). L DTS = KOND - 2 (NO TO 100 LO.200 - 40.50 - 40.50 - 60.70 + 80.50 + 100.110 - 120 + 130 - 140 - 150 + 170.1 C CONTAIN THE GAUSS-LEGENUME POINTS FIM THE STANDARD INTERVAL (1-11). L DTS = KOND - 2 (NO TO 190 | IS PHUMIBITED FOR | | COLPNT | 7.7 |
| C THE USER MAY CHANGE THIS AS DESIRED. C | C THE USER MAY CHANGE THIS AS DESIRED. (| JATA STATEMENT IN | • | COLPNT | 8 |
| The company of the | C COMPUTE THE COLUCATION POINTS TO BE AT THE GAUSS-LEGENDRE POINTS IN C COMPUTE THE COLUCATION POINTS TO BE AT THE GAUSS-LEGENDRE POINTS TO BE AT THE STANDARD INTERVAL (11.1). C EACH PIECEWISE POLYNOWING STORE SUBINIFICAL (11.1). C CONTAIN THE GAUSS-LEGENDRE POINTS FOW THE STANDARD INTERVAL (11.1). LUTS = KOND = 2 GO TO (10.20.30.40.50.60.70.60.70.60.90.100.110.120.130.140.150.170.170.190.100.170.100.110.120.130.140.150.170.170.190.100.170.17 | | | COLPNI | & |
| F NCC NE 2 OUR NOGAUS E'U, 1 GU TU 200 | F NCC NE 2 OH NOGAUS Le 1 GU TU 200 | | ; | COLPNI | 30 |
| C COMPUTE THE COLLOCATION POINTS TO BE AT THE GAUSS-LEGENDRE POINTS TO COLPNI C EACH PIECEWISE POLYNOWHAL SPACE SUBLISTERVAL. THE ARRAY RHO IS SET TO COLPNI C CONTAIN THE GAUSS-LEGENDRE POINTS FOW THE STANDARD INFERVAL (-1-1). C CONTAIN THE GAUSS-LEGENDRE POINTS FOW THE STANDARD INFERVAL (-1-1). COLPNI COLONI INTO TO 10 10 10 10 10 10 10 10 10 10 10 10 10 | C COMPUTE THE COLLUCATION POINTS TO BE AT THE GAUSS-LEGENDRE POINTS IN C EACH PIECEMISE POLYNOWIAL SPACE SUBINTERVAL. THE AKKAY KHO IS SET TO C CONTAIN THE GAUSS-LEGENURE POINTS FOW THE STANDARD INTERVAL (-1.1). C CONTAIN THE GAUSS-LEGENURE POINTS FOW THE STANDARD INTERVAL (-1.1). LDTS = KODD - 2 GO TO (10.20.30.40.50.60.70.60.50.100.110.120.130.140.150.170. 10 HHO(2) = .5773502691H9626E-00 CU TO 190 20 HHO(2) = .5773502691H9626E-00 HHO(1) = . HHO(2) CU TO 190 30 RHU(3) = .77459664241483E-00 HHO(1) = . HHO(4) GO TO 190 40 HHO(2) = . HHO(4) CO TO 190 40 HHO(4) = .861136311594053E-00 HHO(2) = . HHO(4) CO TO 190 40 HHO(3) = . HHO(4) CO TO 190 40 HHO(3) = . HHO(4) CO TO 190 40 HHO(4) = .861136311594053E-00 HHO(1) = . HHO(4) CO TO 190 40 HHO(1) = . HHO(1) CO TO 190 CO T | . 1) GO TO 200 | | COLPNI | = : |
| C COMPUTE THE COLLOCATION POINTS TO BE AT THE GAUSS-LEGENDRE FOINTS IN COLLPNI C EACH PIECEWISE POLYNOWIAL SPACE SUBINTERVAL. THE BARRAY RHO IS SET TO COLPNI C CONTAIN THE GAUSS-LEGENDRE POINTS FOUR THE STANDARD INTERVAL (-1-1). C CONTAIN THE GAUSS-LEGENDRE POINTS FOUR THE STANDARD INTERVAL (-1-1). C COUNTAIN THE GAUSS-LEGENDRE POINTS FOUR THE STANDARD INTERVAL (-1-1). C COLPNI GO TO (10-20-30-40-50-70-60-70-60-70-100-110-120-130-14-0-150-1-70-1-1 | C CUMPUTE THE COLLOCATION POINTS TO BE AT THE GAUSS-LEGENDRE POINTS IN C EACH PIECEWISE POLYNOWING SPACE SUBLINEEWAL. THE AFKAY RHO IS SET TO C CONTAIN THE GAUSS-LEGENUME POINTS FUN THE STANDARD INTERVAL (-1-1). C | | | COLPNI | 36 |
| C CONTROL OF SECURISE POLYNOMIAL SPACE SUBLIFFERVAL. 14th ANKAY KHO IS SET TO COLPNI C CONTROL OF SECURISE POLYNOMIAL SPACE SUBLIFFERVAL (-1-1). C CONTROL OF 2 C CONTROL OF 2 C CONTROL OF 30 40 50 40 50 40 50 40 50 50 50 50 50 50 50 50 50 50 50 50 50 | C EACH PIECENISE POLYNOMIAL SPACE SUBLIFERVAL. THE ARRAY RHO [5] SET TO CONTAIN THE GAUSS-LEGENURE POINTS FUR THE STANDARD INTERVAL [-1-1]. [C | AT THE GAUSS-LEGE | | COLPNI | 33 |
| COLPN1 CO | | TERVAL. THE ARKA | | במרמט | 4 |
| 1975 = KOUD | | 4 THE STANDARD INTO | | COLPNI | 35 |
| IPTS = KOPD = 2 | IPTS = KOPD - 2 GO TO 10-20-30-40-50-60-70-60-90-110-120-130-140-150-170-170-1 HOD 19 | | | COLPNI | ą, |
| (G) TO (10,20,30,40,50,60,70,60,50,100,110,120,130,140,150,170, COLPNI 110,110,110,110,110,110,110,110,110,170,17 | GO TO (10,20,30,40,50,60,70,60,90,110,120,130,140,150,170,10,170,170,170,170,170,170,170,170 | | | COLPNI | 37 |
| HOU(2) = 0. HO(1) = 0. COLPNI CO 190 HO(2) = .577350269149626E-00 COLPNI COLPNI CO 190 HO(3) = .774596649241483E-00 HO(4) = .60 HO(5) = .60 HO(6) = .6 | HO(1) = 0. HO(1) = 0. HO(1) = 0. HO(2) = .577350269149626E - 0. HO(2) = .577350269149626E - 0. HO(1) = - HHO(2) HO(1) = - HHO(2) HO(1) = - HHO(3) HO(2) = 0. HO(3) = .33998104334456E - 0. HO(3) = .33998104334456E - 0. HO(3) = .33998104334456E - 0. HO(3) = .339469310105683E - 0. HO(4) = .534469310105683E - 0. HO(4) = .534469310105683E - 0. HO(4) = .534469310105683E - 0. HO(5) = - HHO(4) HO(5) = - HHO(4) HO(5) = - HHO(5) | 1.100.110.120.130. | | COLPNI | 38 |
| HOU(1) = 0. 60 TO 190 HOU(2) = .577350269149626E-00 HOU(2) = .577350269149626E-00 HOU(1) = . HHO(2) HOU(1) = . HHO(2) HOU(1) = . HHO(3) HOU(1) = . HHO(4) HOU(2) = .339981043584456E-00 HOU(3) = .339981043584456E-00 HOU(4) = .86113631554653E-00 HOU(4) = .86113631554653E-00 HOU(4) = .486113631554654E-00 HOU(5) = . HHO(4) HOU(5) = . HHO(4) HOU(5) = . HHO(4) HOU(5) = . HHO(5) | HHU(1) = 0. 60 TO 190 HHU(1) = -8773502691H9626E-00 HHU(1) = - HHU(2) HHU(1) = - HHU(3) HHU(1) = - HHU(3) HHU(1) = - HHU(3) HHU(1) = - HHU(3) HHU(1) = - HHU(4) | | | COLPMI | 39 |
| COLPNI | 60 TO 190 HHO(2) = .577350269149626E-00 HHO(2) = .577350269149626E-00 HHO(3) = .774596649241483E-00 HHO(2) = .77459664923E-00 HHO(3) = .774596649311594653E-00 HHO(4) = .77350269311594653E-00 HHO(4) = .738469310105643E-00 HHO(3) = .738469310105643E-00 HHO(3) = .738469310105643E-00 HHO(3) = .7461794459344654E-00 | | | COLPNI | 04 |
| HHO (2) = .577350269149626E-00 HHO (2) = .4MD (2) COLPNI CO | HU (2) = .5773502691H9626E-00 HU (1) = - HM (2) HU (3) = .7745966 h y 2414 H 3E-00 HU (1) = - HU (3) HU (1) = - HU (3) HU (2) = 0. HU (2) = 0. HU (3) = .3399 H 104 J y 44 H 56 E-00 HU (2) = .861 J 36 J J J y 40 5 J E-00 HU (4) = .861 J 36 J J J J V 40 5 J E-00 HU (4) = .538469 J J J 10 V 56 H 3 E-00 HU (4) = .538469 J J J V 4 V 5 J H V 6 V E-00 HU (4) = .9061 T 9 H S J J H V 5 V J H V 5 V J H V (4) HU (5) = .9061 T 9 H S J J H V 5 V J H V 5 V J H V (1) HU (1) = 0. | | • | COL PNT | 7 |
| KHU(1) = - PHO(2) 50 TO 190 50 TO 190 50 TO 190 60 | <pre>kHU(1) = - PHO(2) 6U TO 190 JU RHU(1) = - THU(3) HHU(1) = - HHU(3) HHU(1) = 0. GU TO 190 4U HHU(2) = .33998104.3584H56E-00 HHU(4) = .861136311594053E-00 HHU(4) = .861136311594053E-00 HHU(4) = .538469.310105683E-00 HHU(1) = - HHO(4) HHU(1) = - HHO(4) HHU(1) = - HHO(4) HHU(1) = - HHO(4) HHU(1) = - HHO(1) HHU(1) = - HHO(1) HHU(1) = - HHO(1)</pre> | | | COLPNI | 29 |
| 60 TO 190 30 RHU(3) = .774596649241483E-00 HHU(1) = - HHU(3) HHU(1) = - HHU(3) 40 PHU(3) = .339981043384456E-00 HHU(1) = - RHO(1) HHU(1) = - RHO(1) COLPNI HHU(1) = - RHO(1) HHU(1) = - RHO(1) HHU(2) = - RHO(1) HHU(2) = - HHO(1) HHU(2) = - HHO(1) HHU(2) = - HHO(1) HHU(2) = - HHO(2) | 50 TO 190 30 RHU(3) = .774596649241483E-00 RHU(1) = - WHO(3) WHU(2) = 0. GU TO 190 40 WHU(2) = .33998104358E-00 WHU(3) = .861136311594053E-00 WHU(1) = - RHO(4) GU TO 190 TO 190 TO 190 SHU(2) = - RHO(4) HHU(2) = .538469310105683E-00 HHU(2) = .538469310105683E-00 HHU(3) = .9061794455E-00 HHU(3) = .9061794655E-00 | | | COI PNT | 7 |
| 30 RHU(3) = .774596649241483E-00 RHU(1) = - HHU(3) RHU(2) = 0. GU TO 190 40 HHU(3) = .33998104358E-00 HHU(4) = .861136311594053E-00 CULPNI HHU(4) = .861136311594053E-00 CULPNI HHU(4) = .538469310105683E-00 CULPNI HHU(2) = .840643 CULPNI HHU(5) = .90617944593405910105683E-00 CULPNI HHU(5) = .840617944593405910105683E-00 CULPNI CULPNI HHU(5) = .840617944593405910105683E-00 CULPNI HHU(5) = .840617944593405910105683E-00 CULPNI CULPN | 30 RHU(3) = .7459664924 483E-00 RHU(1) = . HHU(3) HHU(2) = .039981 43584 56E-00 40 PHU(3) = .339981 44358 56E-00 HHU(4) = .861 3631 540 53E-00 HHU(4) = .861 3631 540 53E-00 HHU(4) = .5384693 010568 3E-00 HHU(5) = .9061 7944593 63E-00 HHU(5) = .9061 7944593 63E-00 HHU(3) = .0061 7944593 63E-00 | | | 100 EVA | 1 |
| HOULD = HOUSE COLPNI HOUSE = 0.339981043584456E-00 GU TO 190 HOUSE = -840135 HOUSE = -840145 HOUSE = -840175 HOUSE = -8 | HMO(1) = - KHO(3) HMO(1) = - KHO(3) HMO(2) = 0.339981043584M56E-00 HMO(4) = - RHO(4) HMO(4) = - RHO(4) HMO(4) = - RHO(4) HMO(5) = - RHO(5) | | | 100 | 4 |
| HOUGH = - HOUS COLPNI HOUGH COLPNI HOUGH COLPNI HOUGH COLPNI HOUGH COLPNI HOUGH | ###################################### | | . • | | |
| 40 HO (3) = 0. 40 HO (3) = .33998104358E-00 40 HO (3) = .840(3) HO (4) = .8613531554053E-00 HO (4) = .8613531554053E-00 COLPNI HO (1) = .840(4) HO (2) = .840(4) HO (5) = .906179845934054E-00 COLPNI HO (5) = .906179845934054E-00 COLPNI HO (5) = .840(5) | ###################################### | | • | 100 | |
| 60 10 190 40 440(4) = 339981043584456E-00 40 440(4) = -840(3) 40 440(4) = -840(3) 40 440(4) = -840(4) 40 10 190 50 10 190 50 10 190 50 10 190 60 10 190 60 10 190 60 10 190 60 10 190 60 10 190 60 10 190 60 10 190 60 10 190 60 10 190 60 10 190 60 10 190 | 60 10 190 40 HH0(2) = .339981043584H56E-00 HH0(2) = .8613631554053E-00 HH0(4) = .8613631554053E-00 HH0(1) = .400(4) 60 T0 190 50 FH0(4) = .538469310105683E-00 HH0(5) = .400(7) HH0(1) = .400(5) HH0(1) = .400(5) | | - • | COCPA | • |
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| 50 PHG(4) = .538469310105683E-00 RHG(2) = - RHG(4) HHG(5) = .906179445934654E-00 COLPNI HHG(5) = .40675 | 50 PHU(4) = .538469310105683E-00 4HU(2) = - RHO(4) KHU(5) = .906179445938664E-00 HHU(1) = - RHO(5) HHU(3) = 0. | | _ | COLPNI | 53 |
| 4H(1(2) = - RH(1(4) COLPNI H(1(5) = .90617944593H654E-00 COLPNI H(1(1) = - RH(15) COLPNI | 4HU(2) = - 2HO(4). HHU(5) = -906179445934664E-00 HHU(1) = - 2HO(5) HHU(3) = 0. | | , | CULPNI | 7, |
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| HOLO (9) = .86506336c68898c=-00 HOLO 105 [=1.5] UD 105 [=1.5] HOLO 105 [=1.5] UD 105 [=1.5] HOLO 105 [= | | - ; | | 2 6 |
| HHOLOUR HHOLOUR SHOOTH SHO | | H 30 | COLPNI | 3 |
| HHO (10) = .973906528517172E-00 UD 105 I=1.5 UD 105 WHO (1) = .973906528517172E-00 (G) RHO (1) = .069543155952345E-00 HHO (1) = .269543155952345E-00 UD 135 I=1.5 | | # 6 | COLPNI | 5.0 |
| 110 100 101 1 = 1.5 | 7 | | TNOTO | 3 |
| 105 NH 105 1=1.5 106 NH 10 10 10 10 10 10 10 10 | | | | 0 1 |
| 105 | | <u>-</u> | | 47 |
| (0 TO 190 110 HHU(6) = .0 HHU(7) = .269543155952345E-00 HHU(7) = .269543155952345E-00 HHU(10) = .815905612406812E-00 HHU(10) = .81578055740405E-00 HHU(10) = .815780557446057E-00 LUD 115 HHO(1) = .978224654146057E-00 LUD 115 HHO(1) = .HHO(12-1) COLPN1 COLPN1 HHU(1) = .9782465414609E-00 COLPN1 HHU(1) = .31578314963E-00 COLPN1 HHU(1) = .31578314963E-00 COLPN1 HHU(1) = .3157831475E-00 COLPN1 COLPN1 COLPN1 COLPN1 COLPN1 HHU(1) = .90431775537675E-00 COLPN1 HHU(1) = .90431775537675E-00 COLPN1 COLP | | THOUSE THE | TNU IOU | ď |
| 110 thu (6) = .0 HHU(1 0) = .269543155952345E - 00 HHU(1 0) = .319096124266812E - 00 HHU(1 0) = .31909612426812E - 00 COLPNI LIS HHU(1 0) = .318246541460E - 00 COLPNI COLPNI COLPNI HHU(1 0) = .31878314460E - 00 HHU(1 0) = .31878314460E - 00 COLPNI HHU(1 0) = .31878314460E - 00 HHU(1 0) = .31878311460E - 00 COLPNI C | | 001 | 100 | |
| 110 HHU(6) = .0 HHU(7) = .269543155952345E-UU HHU(17) = .269543155952345E-UU HHU(19) = .730155005574049E-UU HHU(10) = .8487062594744695E-UU HHU(11) = .978224654146057E-UU UU 115 1=1,5 UU 115 1 | | 061 01 00 | | * |
| HHO(7) = .26954315595245E-00 HHO(7) = .51909612920681722-00 HHO(10) = .813015200557404922-00 HHO(10) = .813015200557404922-00 HHO(11) = .9782246541460572-00 HHO(11) = .9782246541460572-00 COLPNI 115 HHO(11) = .9782246541460572-00 COLPNI COLPNI HHO(7) = .155234045114692-00 HHO(7) = .155234045114692-00 HHO(8) = .547314746314761142-00 HHO(10) = .9043177553764742-00 HHO(10) = .9043177553764742-00 HHO(11) = .9043177553764742-00 COLPNI HHO(11) = .9043177553764742-00 HHO(11) = .9043177553764742-00 | | ##(C 0) ## | COLDE | 100 |
| HULLON = .519096129206812E-00 HULLON = .730152005574049E-00 HULLON = .730152005574049E-00 HULLON = .730152005574049E-00 HULLON 15 1=1,5 15 HULLON = .978224654146057E-00 17 18 18 18 18 18 18 18 | 200 | 7.1 | TNO ICC | 2 |
| ###################################### | | | | |
| HUG (9) = .730152005574049E-00 HUG (10) = .8670625976409E-00 HUG (11) = .978224654146057E-00 115 HHO (11) = -878224654146057E-00 120 HHO (11) = -8406(12-1) 120 HHO (11) = -8406(12-1) 120 HHO (11) = .357731495981805-00 120 HHO (11) = .964317550376475E-00 120 HHO (11) = .9643175503764775E-00 120 HHO (11) = .9643175503764775E-00 120 HHO (11) = .9643175503764775E-00 | | i C | רטרואי | 7 |
| HUCLID = .88706259764095E-00 HUCLID = .978224654146057E-00 UU 115 1=1.5 115 HUCLID = .4HO(12-1) 60 TO 190 120 HUCL T = .12523404511469E-00 HUCL T = .357831495481190E-00 HUCL T = .367831795444430E-00 HUCL T = .96431775537047E-00 HUCLID = .96431775537047E-00 HUCLID = .9815504344430E-00 COLPNI | | 1) (5) | LNd JOU | 103 |
| HHU(11) = .978224654146057E-DU 115 | | 10) | COLDNI | 104 |
| 115 | | | 20.0 | 2 |
| 115 1=1.5 | | - /17 | | CAT. |
| 115 | 105 | 00 115 1=1 | COLPIES | 901 |
| GO TO 190 120 PHO(7) = .12523404511469E-00 HHO(7) = .35783149898180F-00 COLPNI HHO(9) = .547314984617E-00 COLPNI HHO(10) = .54731478E-00 COLPNI HHO(10) = .90813765578E-00 COLPNI COLPNI HHO(10) = .908156043464719F-00 | | E CLICHA | 724 107 | 107 |
| 120 PHO(7) = 12523404511469E-00 COLPN1 COLPN1 PRO(8) = 357783149599B190E-00 COLPN1 COLPN1 PRO(9) = 35473179545417E-00 COLPN1 COLPN1 PRO(10) = 3547317955574194 305E-00 COLPN1 COLPN1 PRO(11) = 904117555370473E-00 COLPN1 CO | | 001 04 00 | F-10-10-10-10-10-10-10-10-10-10-10-10-10- | |
| 20 PH9(7) = .12523404511469E-00 | | 061 01 09 | נטראט | £ = |
| HHO(B) = 357831495948180F-00 HHO(9) = 5873179542817F-00 COLPNT HHO(10) = 769902674194304F-00 COLPNT HHO(11) = 904117255370473E-00 COLPNT COLPNT COLPNT COLPNT COLPNT | | HHO 2 " | בפרפה | 6 |
| HHO (10) = "SAT31/45428451" | | # CHO | 720 20 | - |
| HO (10) = .5473174545175-00 HO (10) = .76992676144.3045-00 HO (11) = .904117555764755-00 COLPNI COLPNI COLPNI COLPNI COLPNI COLPNI COLPNI COLPNI COLPNI COLPNI COLPNI | , | | | 2 : |
| 101 = .769902674194.304F-00 11) = .904117255370475E-00 12) = .981550434246719F-00 12) = .981550434246719F-00 | 077 | 71197879561181898 = 66 | 2000 | ~ |
| 11) = .904117255374472£-00 12) = .981560434246719F-00 | | 101 = 16990767474144 | 127 27 | 2 |
| 11) = .904]1/2553704/2E-00 12) = .981550434246719F-00 12) = .981550434246719F-00 | | | | |
| 12) = .9815500434246719F-00 | | 2 | ころとと | |
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| 130 HOLD 13 GOLD 130 HOLD | 150 160 | 150 160 | 511 | (1-E1) OHX | COLPNI | 116 |
|--|--|--|----------|--|--|----------|
| 1.50 | 1.50 | 1.0 whi(1 | : | 051 01 09 | COLPNI | 117 |
| 15 | 13 | 135 131 134 134 136 | | # 12 JOHN | COLPAT | 2 |
| 15 | 15 16 16 16 16 16 16 16 | 15 Health | | 1010 41 - 2304 LD 23 LUEL 1 105 | COLONIA | - |
| Heart S = ***444924314940 December | 13 13 13 13 13 13 13 13 | 13 | | 70 C 1 C C C C C C C C C C C C C C C C C | | |
| 13 | 135 131 139 | 1-3 | | 11 | COLDN | 9. 1 |
| 13 | 13 | 135 11-16 1-18015-4-100 | 120 | 11 | 124 100 | <u> </u> |
| 1.5 | 135 136 | 135 136 | | ŧ | TAG IC | 122 |
| 13 | 13 | 13 | | | | |
| 13 13 13 13 13 13 13 13 | 10 15 11 11 11 11 11 11 | 13 13 13 13 13 13 13 13 | | 11 | ייין אייין | 2 |
| 13 14 15 15 15 15 15 15 15 | 1-5 | 1-5 | | H | COLPNI | 124 |
| 135 | 135 | 135 | | = | COL PNT | 125 |
| 10 10 10 10 10 10 10 10 | 10 10 10 10 10 10 10 10 | 10 | 10.1 | 1 1 1 1 1 1 1 | LNG S | 126 |
| 140 140 150 | 140 140 150 | 140 140 150 | | | T. 10.7 | |
| 140 HOLE | 1 | 1 | | 061 01 00 | | |
| HWO(10) = .5152444527890E=00 HWO(11) = .645294481963594E=00 HWO(12) = .946244491963594E=00 HWO(13) = .946244491963594E=00 HWO(13) = .946244491963594E=00 HWO(13) = .946244491963594E=00 HWO(11) = .94624491964394E=00 195 HWO(13) = .94624419194097437E=00 HWO(13) = .9462431944097437E=00 HWO(13) = .94642441396497E=00 HWO(13) = .94642441396497E=00 HWO(13) = .9464244114097447E=00 HWO(13) = .946424114097447E=00 HWO(13) = .946424114097447E=00 HWO(13) = .946541174114097447E=00 HWO(14) = .94654117414097447E=00 HWO(13) = .94654117414097447E=00 HWO(13) = .94654117414097447E=00 HWO(13) = .9465411741409747E=00 HWO(13) = .94657411741409747E=00 HWO(13) = .946574117414097477E=00 HWO(13) = .94667477E=00 HWO(13) = .9466777E=00 HWO(13) = .9466777E=00 HWO(13) = | HHOLID) = .5152444927896E-0U HHOLID) = .615244492789E-0U HHOLID) = .64524449269556E-0U HHOLID) = .94524449269595E-0U HHOLID) = .94624491969595E-0U HHOLID) = .9462449196959E-0U HHOLID) = .9462449196959E-0U HHOLID) = .946214919497437E-0U 150 HHOLID) = .946214919497437E-0U HHOLID) = .946173134017769E-0U HHOLID) = .9461773134017769E-0U HHOLID) = .9461777776776776776776777777777777777777 | Hencit 10 = 5152448427891E=00 Hencit 10 = 687291481194269705E=00 Hencit 10 = 68729148119469756E=00 Hencit 10 = 98729148119469756E=00 Hencit 10 = 98729148119469765E=00 Hencit 10 = 98729148119474717541E=00 Lou 10 10 = 10 = 10 = 10 = 10 = 10 = 10 = | | # (#)OHX | | #2.T |
| HHO(11) = \$497249446126=00 HHO(11) = \$497249446126=00 HHO(11) = \$49724946126=00 HHO(11) = \$4974941245040266=00 HHO(11) = \$4974941245040266=00 HHO(11) = \$49749712150469126=00 HHO(11) = \$4974971731394401766=00 HHO(11) = \$497497173139401760=00 HHO(11) = \$49749711794176090 HHO(11) = \$49749711794176090 HHO(11) = \$49749711794176090 HHO(11) = \$497497117941760900 HHO(11) = \$497497117941760900 HHO(11) = \$49749711794176090 HHO(11) = \$497497117941760900 HHO(11) = \$497497117941760900 HHO(11) = \$4974971179417609000 HHO(11) = \$497497117941760900000000000000000000000000000000000 | HHOLI1) = .6672649461865E=00 HHOLI13) = .94624131909765E=00 HHOLI13) = .946243131909765E=00 HHOLI13) = .946243131909763E=00 HHOLI13) = .946243131909763E=00 HHOLI13) = .946243131969763E=00 HHOLI13) = .946243131969763E=00 HHOLI13) = .946243131969763E=00 HHOLI13) = .9462431317219698341042F=00 HHOLI13) = .94624313172196999991076E=00 HHOLI13) = .9462731317219699991076E=00 HHOLI13) = .9465770129917727F=00 HHOLI13) = .94657701299177727F=00 HHOLI13) = .94657701299177777777777777777777777777777777 | HHOLI1) = .667264946126=00 HHOLI1) = .667264946126=00 HHOLI13) = .94624319196956126=00 HHOLI3) = .946243191969568126=00 HHOLI3) = .946243191969568126=00 HHOLI3) = .946243191969568126=00 HHOLI3) = .94624319409974356=00 HHOLI3) = .946243173154085396=00 HHOLI3) = .93912731964093974356=00 HHOLI3) = .946273196409396416=00 HHOLI3) = .9462731964093966916=00 HHOLI3) = .946279129610006=00 HHOLI3) = .946279129610006=00 HHOLI3) = .946279129610006=00 HHOLI3) = .946279129610006=00 HHOLI3) = .946279129646976=00 HHOLI3) = .946279629129766999 HHOLI3) = .9462796291297999 HHOLI3) = .946279629129799 HHOLI3) = .946279629129799 HHOLI3) = .946279629129799 HHOLI3) = .946279629129799 HHOLI3) = .94627962912979 HHOLI3) = .94627962919 HHOLI3) = .94627962919 HHOLI3) = .94627962919 HHOLI3) = .94627962919 HHOLI3) = .94667962999 HHOLI3) = .946679999 HHOLI3) = .946679999 HHOLI3) = .9466799999 HHOLI3) = .946679999999999999999999999999999999999 | | # (6 | COLPNI | 129 |
| HHULLIS = .687241319095955E-00 HHULLIS = .887241319095955E-00 HHULLIS = .887241319095955E-00 HHULLIS = .887241319095955E-00 184 HHULLIS = .8872413194093955E-00 HHULLIS = .89724134194093955E-00 HHULLIS = .89724173134093955E-00 HHULLIS = .8972425180659341047E-00 HHULLIS = .8972425180659341047E-00 HHULLIS = .89724251806599E-00 HHULLIS = .897242518069699E-00 HHULLIS = .897242518069699E-00 HHULLIS = .89724251806969E-00 HHULLIS = .89724251806969E-00 HHULLIS = .89724251806969E-00 HHULLIS = .897242919969E-00 HHULLIS = .9972419969E-00 HHULLIS = .99727419969E-00 HHULLIS = .99727419969HE-00 HHULLIS = .99727419969HE-00 HHULLIS = .99727419969HE-00 HHULLIS = .99727471199E-00 HHULLIS = .997274771199E-00 HHULLIS = .9972747771199E-00 HHULLIS = .99727477771199E-00 HHULLIS = .99727471199E-00 HHULLIS = .997274771199E-00 | HHULLIS = .68724131909765E-00 HHULLIS = .92843481663576E-00 HHULLIS = .92843481463576E-00 HHULLIS = .92843481463576E-00 HHULLIS = .92843481463576E-00 HHULLIS = .2011940939765E-00 HHULLIS = .2011940939765E-00 HHULLIS = .2011940939765E-00 HHULLIS = .257095217676635E-00 HHULLIS = .257095217676635E-00 HHULLIS = .257095217676635E-00 HHULLIS = .25709721767635E-00 HHULLIS = .25709721767637E-00 HHULLIS = .2984009349116599 HHULLIS = .298401114119 HHULLIS = .298401141119 HHULLIS = .298401141119 HHULLIS = .298401141119 HHULLIS = .298401141119 HHULLIS = .2984011411119 HHULLIS = .298401141119 HHULLIS = .29840111119 HHULLIS = .29840111119 HHULLIS = .2984011119 HHULLIS = .2984011119 HHULLIS = .2984011119 HHULLIS = .2984011119 HHULLIS = .298401119 HHULLIS | HHULLIS = 647291319097055=00 HHULLIS = 948634403063565=00 HHULLIS = 948634403063565=00 HHULLIS = 948634403063565=00 HHULLIS = 3734131904345765=00 HHULLIS = 3734131940345765=00 HHULLIS = 373413471731360176=00 HHULLIS = 37341731360176=00 HHULLIS = 373413417316=00 HHULLIS = 37341731360176=00 HHULLIS = 37341731441146176=00 HHULLIS = 3734173144174616=00 HHULLIS = 3734173144176=00 HHULLIS = 373417314173141731417314173141731417314 | | #1 | COLPNI | 130 |
| He He He He He He He He | Heart 13 1982/2013 509785E-00 | Heat 12 = 48724131949785E=00 | | • | THOTOS | 121 |
| ##01131 = .9487491360375E_0U ##01131 = .9487491360375E_0U ##01131 = .948729137E_0U ##01131 = .948729137E_0U ##01131 = .948731403137E_0U ##01131 = .94873140317E_0U ##01131 = .94873173134017766_0U ##01131 = .9487317313401776E_0U ##01131 = .94874915317E_0U ##01131 = .94877771314017E_0U ##01131 = .9487777714017E_0U ##01131 = .948777777714417E_0U ##01131 = .948777777777777777777777777777777777777 | 145 117 17 17 17 17 17 17 | HHOLIS) = .948(24)40959518E-00 HHOLIS) = .948(24)409596118E-00 HHOLIS) = .948(24)409596118E-00 HHOLIS) = .948(24)40959768E-00 HHOLIS) = .948(24)40959768E-00 HHOLIS) = .948(24)40951769E-00 HHOLIS) = .948(24)408518E-00 HHOLIS = .94 |) s | • | | 7 . |
| HHOLIS I # 92848.481366.3574E-00 HOLIS I I 17 H624.340896812E-00 HOLIS I I 17 H624.340896812E-00 HOLIS I I 17 H624.340896812E-00 HOLIS I I 17 H624.34089681E-00 HOLIS I I 17 H624.47176.5E-00 HOLIS I I 17 H624.471 | HHOULDS I 3.4284.481366.3574.E-00 HOL 145, 1 1.7 H6.24.490.864812.E-00 HOL 145, 1 1.7 H6.24.490.8435.E-00 HHOULD I 1.2 11194.043.4974.35E-00 HHOULD I 2.346.194.043.4974.35E-00 HHOULD I 3.488.266.838.106.204.8376.204 HHOULD I 3.488.266.838.106.204.8376.204 HHOULD I 3.488.266.838.106.204.8376.204 HHOULD I 3.488.266.838.106.204.8376.204 HHOULD I 3.488.266.838.206.83E-00 HHOULD I 3.488.266.838.206.806 HOLD I 4.488.266.838.206.806 HHOULD I 3.488.266.838.206 HHOLD I 3.888.206 HHOLD I 3.888.2 | HHOULDS I S. 9282444134653574E-00 HOLISS I I 17 762743413663574E-00 HOLISS I I 17 762743413663574E-00 HOLIS I I 17 7627435E-00 HOLIS I I 17 7627435E-00 HOLIS I I 17 76274339E-00 HOLIS I I 17 7627439E-00 HOLIS I I 17 | | 11 | | 136 |
| 145 | 145 | 145 HH0(11) =4H62A3H0B996B12E-00 150 HH0(11) =4H62A3H0B996B12E-00 150 HH0(11) =4H62A3H0B996B12E-00 150 HH0(11) =4H0(11S-11) 150 HH0(11) =4941713145017783E-00 150 HH0(11) =4941713145017783E-00 150 HH0(11) =494177131450170E-00 150 HH0(11) =494177131450170E-00 150 HH0(11) =494177131450170E-00 150 HH0(11) =494177131450170E-00 150 HH0(11) =49417417131450170E-00 150 HH0(11) =494174171314717E-01 150 HH0(11) =4941741717E-01 150 HH0(11) =49417417E-01 150 HH0(11) =49417E-01 150 HH0(11) =4941111111111111111111111111111111111 | | ** | COLPNI | 133 |
| 145 141 141 15 15 15 15 | 150 145 141 141 15 15 15 15 | 150 145 14 17 17 17 17 17 17 17 | | r | LVG TOO | 71. |
| 145 UHOI 1 | 15 | 145 WHO(1) = -WHO(15 = 1) COLPMI 156 WHO(1) = -WHO(15 = 1) COLPMI 156 WHO(1) = -S70972172408326=00 | | | F100 100 | |
| 145 | 145 | 155 WHO(1) 15 WHO(1) | | 00 45 1=1. | | <u>.</u> |
| 150 400 10 100 150 140 10 10 100 150 140 10 10 10 10 150 140 10 10 10 10 10 150 15 15 10 10 10 10 151 15 15 10 10 10 152 16 10 10 10 153 16 10 10 10 154 17 10 10 10 155 16 17 10 155 16 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 10 150 17 17 17 17 17 17 150 17 17 17 17 17 17 150 17 17 17 17 17 17 150 17 17 17 17 17 17 150 17 17 17 17 17 17 150 17 17 17 17 17 17 150 17 17 17 17 17 17 150 17 17 17 17 17 17 150 17 17 17 17 17 17 17 17 17 | 150 140 10 190 19403497435E = 00 190 194010 150 140 10 190 19403497435E = 00 194010 15 | 150 140 10 190 194 | 135 | # (I) 0HH | COLDIN | 136 |
| 150 WHO (#) = .0 150 WHO (#) = .0 150 WHO (#) = .00 150 WHO (#) = .39419134707562E-00 150 WHO (1) = .370972132400706E-00 150 WHO (1) = .98727332400706E-00 150 WHO (1) = .98601677765727E-00 150 WHO (1) = .986016776576E-00 150 WHO (1) = .9860167766-00 150 WHO (1) = .98601676-00 150 WHO (1) = .98601676- | 150 WHO (#) = .0 150 | 150 WHO! | | 50 TO 190 | COI PNT | 137 |
| 150 HHO (1) = .570972172-055E-00 HHO (10) = .39451345-00 HHO (11) = .570972172-055E-00 HHO (12) = .9570972172-055E-00 HHO (12) = .993723395-00 HHO (13) = .993723395-00 HHO (14) = .993723395-00 HHO (15) = .993727395-00 HHO (15) = .993723395-00 HHO (11) = .9930172-056-00 HHO (11) = .9930172-056-00 HHO (11) = .9930172-056-00 HHO (11) = .9930172-056-00 HHO (12) = .9930172-056-00 HHO (13) = .75500400372-00 HHO (14) = .965017-072-00 HHO (15) = .993017-072-00 HHO (15) = .994027-072-00 HHO (17) = .9940003397-00 HHO (18) = .9940003397-00 HHO (11) = .91740467-00 HHO (11) = .91740467-00 HHO (11) = .91740467-00 HHO (12) = .9940003397-00 HHO (13) = .974017-00 HHO (14) = .00 HHO (15) = .9940003397-00 HHO (15) = .9940077-000-00 HHO (15) = .9940077-000-000-000-000-000-000-000-000-00 | 150 HHO (1) = .3704512435E-00 HHO (10) = .394451474355E-00 HHO (11) = .570951217505E-00 HHO (12) = .72441773150170C-20 HHO (12) = .92405053341042FE-00 HHO (13) = .937673395400706E-00 HHO (14) = .937773395400706E-00 HHO (15) = .937773395400706E-00 HHO (11) = .946005334077372954-00 HHO (11) = .94600706E-00 HHO (11) = .94600706E-00 HHO (12) = .94607502043753E-00 HHO (13) = .72467502043753E-00 HHO (13) = .72467502043753E-00 HHO (13) = .72467502043753E-00 HHO (14) = .965012504976E-00 HHO (15) = .995002E-00 HHO (13) = .724675020490E-00 HHO (13) = .724675020490E-00 HHO (13) = .724675020490E-00 HHO (13) = .955075075075076-00 HHO (13) = .955075075075076-00 HHO (14) = .995075075075076-00 HHO (15) = .995075075075076-00 HHO (15) = .995075075076076E-00 HHO (15) = .9950750775076076E-00 HHO (15) = .995075075076076E-00 | 150 | | | | , |
| HHOULD 1 = 3944514707356200 HHOULD 1 = 5709721724065300 HHOULD 1 = 5709721724065300 HHOULD 1 = 5709721724065300 HHOULD 1 = 9372733424077056200 HHOULD 1 = 147077562000 HHOULD 1 = 147077562000 HHOULD 1 = 14707757272700 HHOULD 1 = 937273342407706600 HHOULD 1 = 937273342407706600 HHOULD 1 = 937273342407706600 HHOULD 1 = 937273342407706600 HHOULD 1 = 9372733424077066000 HHOULD 1 = 945727707247700 HHOULD 1 = 94577707247700 HHOULD 1 = 9457707247700 HHOULD 1 = 94577707247700 HHOULD 1 = 94577707407407700 HHOULD 1 = 9457777407407700 HHOULD 1 = 9490577477417700 HHOULD 1 = 9490577477417700 HHOULD 1 = 949057747741417700 HHOULD 1 = 94905774774171700 HHOULD 1 = 949057747741700 HHOULD 1 = 949057747741700 HHOULD 1 = 949057747741700 HHOULD 1 = 9490577477417000 HHOULD 1 = 949057477417000 HHOULD 1 = 9490574777000 HHOULD 1 = 94905747770000 HHOULD 1 = 9490574777000 HHOULD 1 = 9490574777000 HHOULD 1 | HHOU(10) = .9394/91347395-00 HHO(110) = .9394/91347395-00 HHO(111) = .9394/91347435-00 HHO(111) = .9394/913724901706-00 HHO(113) = .848206534104218-00 HHO(113) = .89879425140218-00 HHO(113) = .98979425140218-00 HHO(113) = .989400934915506-00 HHO(113) = .9894000934915506-00 HHO(113) = .98940009349150600000000000000000000000000000000000 | HHOULED : 39441514674356200 HHOULED : 374641514674356200 HHOULED : 3746417731542000 HHOULED : 374641773134042176000 HHOULED : 374641773134040000 HHOULED : 3746777276000 HHOULED : 37467727727000 HHOULED : 37467727727727000 HHOULED : 3746772772772772772772772772772772772772772 | | # (2) OHY | COL PN | 138 |
| HHU(10) = .394151347077553E-00 HHU(112) = .75441773140853E-00 HHU(12) = .75441773140853E-00 HHU(12) = .99727399240076E-00 HHU(13) = .9879422180489E-00 HHU(14) = .997727399240076E-00 HHU(15) = .9879422180483F-37E-01 HHU(15) = .9879422180483F-37E-01 HHU(11) = .24801779254E-00 HHU(11) = .24801779254E-00 HHU(11) = .24801779254E-00 HHU(12) = .915404083503E-00 HHU(12) = .99940093499152E-00 HHU(13) = .999400934991550E-00 HHU(14) = .999400934991550E-00 HHU(15) = .999400934991550E-00 HHU(16) = .999400934991550E-00 HHU(17) = .9896291539F-00 HHU(17) = .99957777314417F-00 | HHO(10) = .394(5)1347077563E-00 HHO(11) = .572461773450170E-00 HHO(12) = .72441773450170E-00 HHO(13) = .998705921740920E-00 HHO(11) = .99870593410427E-00 HHO(11) = .99870593410427E-00 HHO(11) = .998705934104727E-00 HHO(11) = .99870593410477250 HHO(11) = .9987073393410477250 HHO(11) = .9987073393410477250 HHO(11) = .9887073393410477250 HHO(11) = .99870733934104777250 HHO(12) = .99870737393476E-00 HHO(13) = .99870737393476E-00 HHO(14) = .998707373447777777777777777777777777777777 | HHOULD = 394151347077563E-00 HHOULD = 272441773451E-00 HHOULD = 937273394241042FE-00 HHOULD = 937273394241042FE-00 HHOULD = 93727339421042FE-00 HHOULD = 93727339421042FE-00 HHOULD = 93727339421042FE-00 HHOULD = 93727339421042FE-00 HHOULD = 94727339421042FE-00 HHOULD = 2916035907334FE-00 HHOULD = 2916035907325FE-00 HHOULD = 29160359073237E-00 HHOULD = 29160359073727E-00 HHOULD = 291603590737272FE-00 HHOULD = 29160359073737E-00 HHOULD = 29160359073737E-00 HHOULD = 29160359073737E-00 HHOULD = 2946575023737E-00 HHOULD = 39465750237727E-00 HHOULD = 3946575023772FE-00 HHOULD = 3946775023772FE-00 HHOULD = 394677502772FE-00 HHOULD = 3946777502772FE-00 HHOULD = 394677770272FE-00 HHOULD = 39467777077777777777777777777777777777777 | | 11 60 | COLPNI | 139 |
| HHO(11) = .576072172408539E-00 HHO(12) = .984206593406210E-00 HHO(13) = .984206593400216E-00 HHO(13) = .987992518020488E-00 HHO(13) = .987992518020488E-00 HHO(13) = .987992518020488E-00 COLPNI 155 | HULLID : 5.754072172408539E-00 HULLID : 5.754072172408539E-00 HULLID : 5.7547313471076E-00 HULLID : 9.84620593310E-00 HULLID : 9.84620593310E-00 HULLID : 9.84620593310E-00 HULLID : 9.857942518026456E-00 HULLID : 2.81601259073254E-01 HULLID : 2.81601259073254E-00 HULLID : 2.81601259073254E-00 HULLID : 2.81601259073254E-00 HULLID : 3.8560167275727E-00 HULLID : 3.8560167275727E-00 HULLID : 3.8560167275727E-00 HULLID : 3.84677923137E-00 HULLID : 3.8467793137E-00 HULLID : 3.8467793137E-00 HULLID : 3.846779314417E-00 HULLID : 3.846779314417E-0 | ##01(11) = .570972172302-00 ##01(13) = .570972172302-00 ##01(13) = .937072172008530-00 ##01(13) = .937072172008530-00 ##01(13) = .937072172008530-00 ##01(13) = .937072172008530-00 ##01(13) = .937072372020-00 ##01(13) = .937072372020-00 ##01(13) = .937072372020-00 ##01(13) = .937072372020-00 ##01(13) = .945072020020-00 ##01(13) = .945072020020-00 ##01(13) = .94507202002-00 ##01(13) = .945072020020-00 ##01(14) = .94507202000000000000000000000000000000000 | | | 100 | |
| HWO (113) = .5.509.21 Zeba83.98 = .0 u HWO (123) = .764417313460170E = 0 u HWO (124) = .93727339.540070EE = 0 u HWO (135) = .94827054810427E = 0 u HWO (135) = .94827054810 = .94827054E = 0 u HWO (135) = .9482705481737E = 0 u HWO (135) = .9485911404547 = 0 u HWO (145) = .9485911765491 = 0 u HWO (145) = .948591176417E = 0 u HWO (145) = .94859178278 = 0 u HWO (155) = .94857078278 = 0 u HWO (145) = .94857078278 = 0 u HWO (155) = .94857078278 = 0 u HWO (125) = .94857078 = 0 u HWO (125) = .94857078 = 0 u HWO (125) = .94857078278 = 0 u HWO (125) = | HHO(11) = .519051706-00 HHO(12) = .9462172173410427E-00 HHO(14) = .9494177314041706 HHO(14) = .94972734240706E-00 HHO(14) = .94972734240706E-00 HHO(15) = .949407742104047E-00 HHO(17) = .949127407421407427E-00 HHO(17) = .94912741474174174174174174111-00 HHO(17) = .94940747E-00 HHO(17) = .94940747E-00 HHO(18) = .94940747E-00 HHO(18) = .94657417E-00 HHO(18) = .94657417E-00 HHO(19) = .94657417E-00 HHO(19) = .94657417E-00 HHO(11) = .949677417E-00 | WHO(11) = .51092122-008539E-00 WHO(12) = .54417731406170E-00 WHO(13) = .9842043410427E-00 WHO(13) = .984294210427E-00 WHO(14) = .984794251402048FE-00 Un 15.5 = 11.7 Un 17.5 = 11.7 Un | | H | 100 | 3 |
| HHO(12) = .72441731J60170E-00 HHO(13) = .9482092514020485E-00 HHO(14) = .948727392440706E-00 HHO(15) = .948727392440706E-00 HHO(16) = .948727392440706E-00 HHO(17) = .9487042514020485E-00 HHO(10) = .2416035507792592 HHO(11) = .2416035507792592 HHO(11) = .2416035507792592 HHO(11) = .2416035507792592 HHO(12) = .2416035507792592 HHO(13) = .24865702307338-00 HHO(13) = .24865702307338-00 HHO(13) = .24867702307338-00 HHO(13) = .949640849E-00 HHO(13) = .949640849E-00 HHO(13) = .95767132409 HHO(13) = .95767132409E-00 HHO(13) = .95767132409E-00 HHO(14) = .949677E-00 HHO(15) = .95767134099E-00 HHO(15) = .95767134099E-00 HHO(16) = .95767134099E-00 HHO(17) = .949677E-00 HHO(18) = .95767134099E-00 HHO(18) = .949677E-00 HHO(19) = .95767134099E-00 HHO(19) = .95767134099E-00 HHO(11) = .949677E-00 HHO(11) = .949677E-10 H | HHO(12) = .724417731J60170E-00 HHO(12) = .9872733944076E-00 HHO(13) = .98779451802768E-00 HHO(14) = .99779451802768E-00 HHO(15) = .9977945180276E-00 HHO(15) = .9977945180276E-00 HHO(11) = .4880125998376376E-01 HHO(11) = .488017776546E-00 HHO(11) = .78865120248733E-01 HHO(12) = .98457923333E-00 HHO(13) = .7845782803E-00 HHO(14) = .9845782803E-00 HHO(14) = .9845782803E-00 HHO(15) = .99847948F-00 HHO(15) = .99847948F-00 HHO(16) = .91518948F-00 HHO(17) = .4886811E-00 HHO(18) = .94868711592868911E-00 HHO(18) = .948677833F-00 HHO(19) = .781518948F-00 HHO(11) = .781518948F-00 HHO(11) = .781518948F-00 HHO(11) = .98667787818F-00 HHO(11) = .99667787818F-00 HHO(11) = .99667787818F-00 HHO(11) = .996678818F-00 HHO(11) = .996678818F-00 HHO(11) = .996678818F-00 HHO(11) = .996678818F-00 HHO(11) = .9966788188888888888888888888888888888888 | HHO(12) = .72441731J60170E-00 HHO(12) = .997992514027E-00 HHO(13) = .997792514027E-00 HHO(13) = .997792514027E-00 HHO(13) = .997792514027E-00 HHO(13) = .997792514027E-00 HHO(13) = .9960293491632E-01 HHO(13) = .99602942E-01 HHO(13) = .99602942E-01 HHO(13) = .99602942E-01 HHO(13) = .99602942E-01 HHO(13) = .99940093491563E-01 HHO(13) = .99940093491550E-01 HHO(14) = .99940093491550E-01 HHO(15) = .99940093491550E-01 HHO(15) = .9994009349150E-01 HHO(16) = .9994009349150E-01 HHO(17) = .9994009349150E-01 HHO(18) = .9994009349150E-01 HHO(18) = .9994009349150E-01 HHO(18) = .999409150E-01 HHO(18) = .999409349150E-01 HHO(18) = .999409150E-01 HHO(18) = .999409150E-01 HHO(18) = .999409150E-01 HHO(18) = .999409150E-01 HHO(18) = .9994093415091E-01 HHO(18) = .9994 | - 7 | 66 | COL 911 | 7 |
| Health H | Health H | Hear | | • | Control | 242 |
| HHO(13) = .848208931042FE-00 HHO(14) = .99773339402065E-00 HHO(15) = .9977923394200706E-00 HHO(18) = .9977923394200706E-00 HHO(18) = .997792339420706E-00 HHO(18) = .996125949376E-01 HHO(18) = .996125949376E-01 HHO(18) = .996167775727E-00 HHO(18) = .9966312082969E-00 HHO(18) = .9966312082969E-00 HHO(18) = .99660939491850E-00 HHO(18) = .99660939178691E-00 HHO(18) = .99660939178691E-00 HHO(18) = .996607552176918691E-00 HHO(18) = .99667552176918691E-00 HHO(18) = .9966755691E-00 HHO(18) = .9966755691E-00 HHO(18) = .9966756761E-00 HHO(18) = .996676761E-00 HHO(18) = .99667761E-00 HHO(18) = .996676186186186186186186186186186186186186186 | HHO(113) = .98729334627E-00 HHO(114) = .987293394627E-00 HHO(115) = .987293394627E-00 HHO(116) = .98729339462E-00 HHO(117) = .98729339462E-00 HHO(118) = .986125949376E-01 HHO(119) = .986125949376E-01 HHO(119) = .9861259473259E-00 HHO(119) = .9861259473259E-00 HHO(119) = .986035503E-00 HHO(119) = .98660464E-00 HHO(119) = .98660464E-00 HHO(119) = .98660464E-00 HHO(119) = .98660493491550E-00 HHO(119) = .986604946E-00 HHO(119) = .98660493491550E-00 HHO(119) = .986604946E-00 HHO(119) = .9866046B-00 HHO(119) = .986604B-00 HHO(119) = .9866046B-00 HHO(119) = .986604B-00 HHO(119) = .986604B-00 HHO(| HHO(113) = .98729334540106E-00 HHO(114) = .98729339440106E-00 HHO(115) = .98729339440106E-00 HHO(115) = .98729339440106E-01 155 HHO(115) = .98729339440106E-01 160 HHO(115) = .986125504831625E-01 HHO(115) = .98612550476294E-01 HHO(115) = .9866135047762526E-01 HHO(116) = .986613514-01 HHO(116) = .986613514-01 HHO(116) = .986613514-01 HHO(116) = .986613514-01 HHO(116) = .9866141496477E-01 HHO(1175) = .99062912376-01 HHO(118) = .990679477E-01 HHO(118) = .990679477E-01 HHO(118) = .990679477E-01 HHO(118) = .990679477E-01 HHO(119) = .990679477E-01 | | ı | י בי | |
| HHO (14) = .9372733240706E-00 HHO (15) = .9472733240706E-00 HHO (1) = .487492514020485E-00 (0) 155 1 = 1.7 (0) 150 190 (1) 10 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) 10 10 10 (1) | HHO(14) = .9372733240706E-00 HHO(14) = .9477733240706E-00 HHO(1) = .480147742540700 150 HHO(1) = .28014774254E-01 HHO(1) = .280147774254E-01 HHO(1) = .280147774234E-01 HHO(1) = .38014774E-01 HHO(1) = .38124174E-01 HHO(1) | HHOLLS) = .937223392400706E-00 HHOLLS) = .94722518020485E-00 155 HHOLLS) = .498792518020485E-00 160 HHOLLS) = .498792518020485E-00 160 HHOLLS) = .498792518020485E-00 160 HHOLLS) = .4986125048376-01 160 HHOLLS) = .4986125048376-01 160 HHOLLS) = .4986125048376-01 160 HHOLLS) = .4986125048376-01 160 HHOLLS) = .4986125048782E-00 160 HHOLLS) = .4986609349155E-00 170 HHOLLS) = .498660936-00 170 HHOLLS) = .498660936-00 170 HHOLLS) = .498660936-00 170 HHOLLS) = .498660936-00 170 HHOLLS) = .498691E-00 170 HHOLLS) = .498660936-00 170 HHOLLS) = .49866096-00 170 HHOLLS) = .49866096-00 170 HHOLLS) = .49866096-00 170 HHOLLS) = .498690996-00 170 HHOLLS) = .49866096-00 170 HHOL | | 11 | COLPAN | 143 |
| Hours Harris Ha | HHO(15) = .99797518020485E-00 155 | HHO (15) = .997992518020485E-00 155 1= 1.7 150 150 1= 1.7 151 151 1.7 152 1= 1.7 153 1= 1.7 150 19 | | 11 | COLPNI | 777 |
| 155 = 147 COLEMIT 150 HHO(11) = .4816(15-1) COLEMIT 150 HHO(13) = .950125094376374E-01 150 HHO(19) = .93162509437637E-01 150 HHO(19) = .931625094376324E-00 150 HHO(19) = .9316037773334E-00 150 HHO(11) = .94657527E-00 150 HHO(11) = .9465752726E-00 150 HHO(11) = .946575273334E-00 150 HHO(11) = .946575273334E-00 150 HHO(11) = .946575273334E-00 150 HHO(11) = .94657573334E-00 150 HHO(11) = .94657573334E-00 150 HHO(11) = .94657573334F-00 150 HHO(11) = .95567573334F-00 150 HHO(11) = .955675733476E-00 150 HHO(11) = .9567573344417E-00 150 HHO(11) = .94657573344417E-00 170 HHO(11) = .94657573344417E-00 170 HHO(11) = .9465757334417E-00 170 HHO(11) = .94677334417E-00 170 HHO(11) = .94677344417E-00 170 HHO(11) = .94677344417E-00 170 HHO(11) = .94677344417E-00 170 HHO(11) = .94677344417E-00 170 HHO(11) = .946773444141 | 155 = 117 | 155 1 = 1,7 17,12,13,12,12,12,13,13,12,13,13,12,13,12,13,12,13,13,12,13,13,12,13,13,12,13,13,13,13,13,13,13,13,13,13,13,13,13, | | | ING ICL | 145 |
| 155 161 157 161 | 15 | 19 15 1 1 1 1 1 1 1 1 | | ٠. | | |
| 155 H40(1) = -H40(15-1) | 155 H40(1) = -H40(15-1) | 155 H40(11) = -H40(15-1) COLEMIT 160 H40(19) = .950125094376=01 160 H40(19) = .9510125094376254E=01 160 H40(19) = .954064757276E=01 160 H40(19) = .955404402644E=00 160 H40(19) = .964575021337E=00 160 H40(19) = .99940934991650E=00 160 H40(19) = .99940934991650E=00 160 H40(11) = -H40(17-1) 160 H40(11) = -H40(17-1) 160 H40(11) = .9994093491E=00 160 H40(11) = .9994093491E=00 160 H40(11) = .999675>216691E=00 160 H40(11) = .999675>216691E=00 160 H40(11) = .999675>216691E=00 175 H21 H21 H21 H21 180 H40(11) = .H40(11-1) 180 H40(11-1) 180 H40(11-1) 180 H40(11-1) 180 H40(11-1) 180 H40(11 | 145 | 00 155 1 = | 200 | £ |
| 60 TO 190 160 HOU 19 = .956125098374E-01 HOU 110 = .28601677657227E-00 HOU 112) = .67801677657227E-00 HOU 113 = .95601677657227E-00 HOU 114) = .9660355073237E-00 HOU 115) = .986631260238732E-00 HOU 116) = .986631260238732E-00 HOU 116) = .986631260238732E-00 HOU 1170 = .986675023073237E-00 HOU 1180 = .986675023073237E-00 HOU 1190 = .178644141495444E-00 HOU 1191 = .317844141495444E-00 HOU 1191 = .317844141495444E-00 HOU 1191 = .31784141495444E-00 HOU 1191 = .317844141495444E-00 HOU 1191 = .3178441417E-00 HOU 1191 = .99667554714417E-00 HOU 1191 = .99667554714417E-00 HOU 1191 = .99667554714417E-00 HOU 1191 = .99667554714417E-00 HOU 1191 = .9966754714417E-00 HOU 1191 = .9966755714417E-00 HOU 1191 = .9966757714417E-00 HOU 1191 = .9966757714417E-00 | 60 TO 190 160 HHO(19) = .29160355049246E-01 HHO(10) = .29160355049299E-00 HHO(11) = .458016776572276 HHO(11) = .458016776572276 HHO(11) = .458016776572276 HHO(11) = .946573023316-00 HHO(11) = .946673023316-00 HHO(11) = .351243176441144954466916-00 HHO(12) = .512691531764114495466916-00 HHO(13) = .95067521764186916-00 HHO(11) = .95067521764186916-00 HHO(12) = .94067521764186916-00 HHO(13) = .95067521764186916-00 HHO(13) = .95067521764186916-00 HHO(13) = .95067521764186916-00 HHO(11) = .95067521764186-00 HHO(12) = .94067521764186-00 HHO(13) = .94067521764186-00 | 60 TO 190 | | HOC. | COLMAT | 147 |
| 160 | 160 | 160 | | 100 | Co out | 440 |
| 160 140(1 9) = .950(1250/983/6276-01) | 160 1400 9 = ,295012501935624E=01 | 100 HH0(10) = .29601550779559E-01 100 HH0(10) = .29601677657257E-01 HH0(110) = .296016777657257E-01 HH0(112) = .617876244029603E-00 HH0(12) = .917624402903E-00 HH0(14) = .9660342915297323B-00 HH0(14) = .966034297323B-00 HH0(15) = .999000934991650E-00 HH0(16) = .999000934991650E-00 HH0(11) = .999000934991650E-00 HH0(11) = .91784418414958448E-00 HH0(12) = .917844184189586E-00 HH0(13) = .9512312376986E-00 HH0(13) = .9512312376986E-00 HH0(14) = .9960575472314417E-00 HH0(15) = .9960575472314417E-00 HH0(17) = .9960575472314417E-00 HH0(18) = .896016-00 HH0(18) = .896016-00 HH0(18) = .896016-00 HH0(18) = .9180018-00 HH0(18) = .9180018 | | 061 01 00 | | |
| HHU(10) = .2816035507F=00 HHU(11) = .4580167765727F=00 HHU(12) = .4580167765727F=00 HHU(12) = .4580167765727F=00 HHU(13) = .9184040135003E=00 HHU(14) = .918400934991650E=00 HHU(15) = .918400934991650E=00 HHU(15) = .918400934991650E=00 HHU(15) = .918400934991650E=00 HHU(15) = .9184017F=1) COLPNI IOUTO 190 IOUTO 190 IOUTO 190 HHU(11) = .31269103404F=00 HHU(12) = .51269103404F=00 HHU(13) = .957671159216909496901E=00 HHU(14) = .51269103404F=00 HHU(15) = .9186023415376946E=00 HHU(16) = .990677475314417F=00 COLPNI IOUTO 175 1=14 I | HHO(10) = .29160355079259E-00 HHO(11) = .45801677057227E-00 HHO(12) = .6178762440264E-00 HHO(13) = .75540440835003E-00 HHO(14) = .9656312023073233E-00 HHO(14) = .99467326790 HHO(14) = .9946773233E-00 HHO(15) = .994677826-00 HHO(18) = .9946778200 HHO(19) = .01784411495844E-00 HHO(11) = .351291754548F-00 HHO(11) = .351291754548F-00 HHO(12) = .512690353046677E-00 HHO(13) = .657671354346E-00 HHO(14) = .95667542154417E-00 HHO(15) = .996675477E-00 HHO(15) = .996675477E-00 HHO(15) = .996675477E-00 HHO(17) = .996675477E-00 HHO(18) = .956675477E-00 HHO(18) = .956675477E-00 HHO(18) = .996675477E-00 HHO(18) = .99667547E-00 HHO(18) = .996675477E-00 HHO(18) = .99667547TE-00 HHO(18) HHO(18) HHO(18) HH | HHO(10) = .29160355077057259E-00 HHO(11) = .45801677057257E-00 HHO(13) = .61747057257E-00 HHO(13) = .657402644E-00 HHO(14) = .94560192649163E-00 HHO(14) = .946503120C387832E-00 HHO(16) = .99940093491650E-00 COLPNI 100 HHO(18) = .99940093491650E-00 HHO(18) = .99940093491650E-00 COLPNI 101 HHO(18) = .91740144144944F-00 HHO(18) = .917401441744174417441744174417333E-00 HHO(18) = .9576773119976E-00 HHO(18) = .9576773119417333E-01 COLPNI 175 HHO(18) = .9506755273144174-00 HHO(18) = .940677547333E-01 COLPNI 190 HHO(18) = .940677547333E-01 COLPNI 190 HHO(18) = .9447750139417333E-01 | | # (6)OHR | COLPINI | 7.7 |
| HHO(11) = .45801677752727E-00 HHO(12) = .617876244026441-00 HHO(13) = .458016777532727E-00 HHO(14) = .954044026441-00 HHO(14) = .9645750237E-00 HHO(15) = .9645750237E-00 HHO(16) = .964575023073237E-00 HHO(16) = .9945750237E-00 HHO(17) = .9945750237E-00 HHO(18) = .9945750237E-00 HHO(18) = .9945750237E-00 HHO(18) = .9945750237E-00 HHO(19) = .01744411495444F-00 HHO(19) = .01744411495444F-00 HHO(11) = .9126911531763453476E-00 HHO(11) = .957671159216691E-00 HHO(11) = .957671159216691E-00 HHO(11) = .957671154417E-00 HHO(18) = .996675475314417E-00 | HHO(12) = .45801677752727E-00 HHO(12) = .6178762446264E-00 HHO(13) = .75540440135028E-00 HHO(13) = .7554044013523E-00 HHO(14) = .9654312063477833E-00 HHO(15) = .9645790234991650E-00 HHO(16) = .9646790234991650E-00 OU 165 I=1.6 IO 165 I=1.6 IO 165 I=1.6 HHO(16) = .364631E-00 HHO(17) = .35123176346HE-00 HHO(18) = .0 HHO(18) = .0 HHO(19) = .95467776-00 HHO(19) = .95467776-00 HHO(19) = .9546776176-00 HHO(19) = .9546776176-00 HHO(19) = .9546776176-00 HHO(19) = .9646776176-00 HHO(19) = .966776176-00 HHO(19) = . | HOU (11) = .45801677657227E=00 HOU (13) = .75540440835003E=00 HOU (14) = .86563120244026440 HOU (14) = .8656312024035003E=00 HOU (15) = .989400934991650E=00 HOU (16) = .989400934991650E=00 HOU (16) = .989400934991650E=00 OU 165 1=1.46 OU 10 100 OU 10 100 OU 10 100 HOU (11) = .317444114958444E=00 HOU (12) = .3174444114958444E=00 HOU (13) = .951671159216691E=00 HOU (13) = .951671159216691E=00 HOU (14) = .99067592176417E=00 HOU (15) = .99067592176417E=00 HOU (17) = .99067592176417E=00 HOU (17) = .99067592176417E=00 HOU (17) = .990677917353E=01 HOU HOU (16) = .847750139417353E=01 OU 70 170 OU 70 | | 1000000 | COLPNI | 150 |
| ###################################### | ###################################### | HHO(12) = .4550101717 = .600 PM PECA PECA PECA PECA PECA PECA PECA PECA | | • | Lacino | |
| HHU(12) = .617#762446_00 HHU(13) = .75540440246_00 HHU(13) = .944575023603E_00 HHU(14) = .94457502307323F_00 HHU(15) = .94457502307323F_00 HHU(16) = .94457502307323F_00 HHU(16) = .94457502307323F_00 HHU(18) = .949457502307323F_00 UD 165 I=1.6 I/O HHU(19) = .7744414149544F_00 HHU(11) = .31744414149544F_00 HHU(13) = .512590357647F_00 HHU(13) = .512590357647F_00 HHU(13) = .950675-217641749F_00 HHU(15) = .990675-2176417F_00 HHU(16) = .950675-2176417F_00 HHU(17) = .990675-2176417F_00 HHU(18) = .990675-2176417F_00 HHU(18) = .990675-2176417F_00 HHU(18) = .940675-2176417F_00 HHU(18) = .940675-2176417F_00 HHU(18) = .9406775-2176417F_00 HHU(18) = .9406775-21767F_00 HHU(18) = .9406775- | HHU(12) = .6178762644E-UU HHU(13) = .755404402644E-UU HHU(14) = .946575U23U73233E-UU HHU(15) = .946575U23U73233E-UU HHU(16) = .946575U23U73233E-UU HHU(16) = .946575U23U73233E-UU HHU(16) = .946575U23U73233E-UU HHU(17) = .946575U23U73233E-UU HHU(18) = .946575U23U73233E-UU HHU(19) = .946575U23U73233E-UU HHU(19) = .946575U23U73233E-UU HHU(19) = .91269U3144E-UU HHU(19) = .94057547314417E-UU HHU(19) = .940575477417E-UU HHU(19) = .9405747417E-UU HHU(19) = .9406 | HHU(12) = .61787624402644E-00 HHU(13) = .9465750230200 HHU(14) = .94657502303E-00 HHU(15) = .94657502303E-00 HHU(17) = .94657502303E-00 HHU(18) = .94657502303E-00 HHU(18) = .94657502303E-00 HHU(18) = .9465750303E-00 HHU(18) = .9576713537E-00 HHU(18) = .9506755573154417E-00 HHU(18) = .940575475314417E-00 HHU(18) = .940575475413538E-01 | ٥٢. | H | | 161 |
| HHU(13) = .755404408355003E-00 HHU(14) = .8653120238783E-00 HHU(15) = .94657502303E-00 HHU(16) = .994600934991650E-00 HHU(16) = .994600934991650E-00 100 165 1=1.6 100 165 161 161 161 161 161 161 161 161 161 | HHU (14) = .755404408355003E-00 HHU (14) = .865631202387832F-00 HHU (14) = .9656730239F-00 HHU (16) = .98940093491650E-00 HU (16) = .98940093491650E-00 HU (16) = .98940093491650E-00 HU (16) = .98940093491650E-00 HHU (17) = .17444111495944F-00 HHU (11) = .351269053176-00 HHU (11) = .351269053176-00 HHU (13) = .657671159216691E-00 HHU (14) = .781514003496801E-00 HHU (16) = .995675-21764164E-00 HHU (17) = .996675-21764164E-00 HHU (17) = .996675-21764164E-00 HHU (17) = .996675-214417F-00 HHU (17) = .996675-21764164E-00 HHU (17) = .996675-214417F-00 HHU (17) = .996675-214417 | HHU (14) = .755404408355003E-00 HHU (14) = .865312023873239F-00 HHU (14) = .9856312023873239F-00 HHU (15) = .98940093491650F-00 HU (16) = .98940093491650F-00 HU (16) = .98940093491650F-00 170 HU (10) = .178444181495848F-00 HU (10) = .178444181495848F-00 HU (10) = .178444181495848F-00 HU (10) = .178444181495848F-00 HU (11) = .3512591533876E-00 HU (11) = .351259153726948F-00 HU (11) = .98967552176818417F-00 HU (11) = .99067552176818417F-00 HU (11) = .99067552176818417F-00 HU (11) = .98406755139417353F-01 HU H | | 81 | COLDIN | 152 |
| HHO (14) = .8656312023073233F-00 HHO (16) = .989400934991650F-00 HHO (16) = .989400934991650F-00 LO 165 I=1.8 LO 165 I=1.8 LO 16 I=1.8 LO 10 I6 I= .089400934991650F-00 LO 10 I6 I= .089400934991650F-00 HHO (10) = .17844414149544F-00 HHO (11) = .312491744417 HHO (11) = .31249174447 HHO (12) = .51249174447 HHO (13) = .5124917447 HHO (13) = .512491747 HHO (14) = .996675-2164174-00 HHO (15) = .996675-2164174-00 HHO (16) = .996675-2164174-00 HHO (17) = .996675-2164174-00 HHO (18) = .996675-2164174-00 HHO (17) = .996675-2164174-00 HHO (17) = .996675-2164174-10 COL PNI (18) I= .996675-2164174-10 | HHO (14) = .96563120230732312-00 HHO (16) = .989400934991650E-00 HHO (16) = .989400934991650E-00 LD 165 1=1.6 LD 16 | HHO (14) = .8656312023073233F-00 HHO (16) = .989400934991650F-00 HHO (16) = .989400934991650F-00 LO 165 I=1.6 COLPNI II COLPNI II LO 160 = .174441149544F-00 HHO (13) = .912415376491F-00 HHO (13) = .956675-216691F-00 HHO (14) = .956675-216691F-00 HHO (16) = .956675-216417F-00 HHO (16) = .956675-216417F-00 HHO (16) = .956675-216417F-00 HHO (16) = .956675-216417F-00 HHO (16) = .9467750130417353F-01 LO 70 170 I 70 HHO HHO II = .847750130417353F-01 LO 170 HHO HHO II = .847750130417353F-01 | | | TNG SC | - 5 |
| HHO (15) = .86563120238737E-00 HHO (16) = .964575023073239F-00 HHO (16) = .994675023073239F-00 HHO (16) = .994600934991650E-00 LO 165 1=1.6 LO 165 1 | HHO (14) = .86563120238782F-00 HHO (16) = .986400934991650F-00 HHO (16) = .986400934991650F-00 HHO (16) = .989400934991650F-00 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 165 1=1.8 100 175 1=1.8 | HHO (15) = .86563120238782E-00 HHO (16) = .9946375023073239F-00 HHO (16) = .994600934991650E-00 LO 165 [=1.6] 100 165 [=1.6] 101 HHO (1) = .9464702E-00 HHO (10) = .17844414149544E-00 HHO (11) = .351231763423876E-00 HHO (11) = .351231763423876E-00 HHO (11) = .351231763423876E-00 HHO (11) = .9165915317634631E-00 HHO (11) = .95667552176417E-00 HHO (11) = .99657547511378691E-00 HHO (11) = .99657547511378691E-00 HHO (11) = .9965754751139417353E-01 (OLD MI) HHO (11) = .847750130417353E-01 HHO HHO HHO = .847750130417353E-01 | | • | | |
| WHO (15) = .944575023073233F-00 | WHO (15) = .9445750230723033F-00 | WHO (15) = .9445750230723073233F-00 | | 11 | | 1,5 |
| HOU [16] = .989400934991650F-00 LO [165 1=1.4] LO [165 1=1.4] LO [165 1=1.4] LO [16] = .HO(1] = .HO(1] = .HO(1] = .OUENT 10 10 10 10 10 10 10 1 | HOUSE = .999400934991650F-00 LO 165 I=1.8 | HOU [16] = .989400934991650E-00 LO [65 1=1.8] LO | | H | COLPIN | 155 |
| 100 165 = 1.64 100 165 = 1.64 100 165 = 1.64 100 165 = 1.64 100 165 = 1.64 100 1 | 170 165 = 1.66 165 164 161 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 17-1 170 190 190 190 190 170 190 190 190 190 170 190 190 190 190 170 190 190 190 190 190 170 190 190 190 190 190 190 170 190 | 10 165 = 1.6 COLPNI 10 165 HU(1) = -kH0(17-1) COLPNI 10 10 10 10 10 10 10 1 | 7 | • | Tug ISS | 7.5 |
| 165 167 | 165 1816 165 1816 160 105 1816 170 180 170 180 18 20 180 170 180 18 20 180 180 180 180 180 180 180 180 180 180 180 | 165 167 | • | | | . : |
| 105 | 165 | 105 | | 00 165 I=I• | בל ל | 12(|
| 170 | 170 HU (9) = .0 HU (10) = .174441H149544F-UU HU (11) = .35123176343HF-UU HU (11) = .35123176343HF-UU HU (11) = .51269U5341647F-UU HU (12) = .51269U5341537269HF-UU HU (13) = .65767115921669IE-UU HU (14) = .7815140U38968U1E-UU HU (15) = .99057547716H69HE-UU HU (17) = .9905754774171717171717171717171717171717171 | 170 | | 1 (2) | COLPNI | 158 |
| 170 40(10) = .0 40(10) = .0 40(10) = .0 1744414149544F-00 COLPNI HHO(10) = .051269053175465-00 COLPNI HHO(11) = .35123175493876E-00 COLPNI HHO(12) = .551269053418216691E-00 COLPNI HHO(13) = .455671594216691E-00 COLPNI HHO(15) = .4566754217641764E-00 COLPNI HHO(15) = .9506754217641764E-00 COLPNI HHO(16) = .9506754217641764E-00 COLPNI HHO(17) = .9405754753144174-00 COLPNI HHO(18) = .4400114-10 COLPNI HHO(19) = .4400114-1 | 170 | 170 | | 30 | Tug of | 011 |
| 1'0 kHu(9) = .0 Hu(10) = .35123176.34944F-00 Hu(10) = .35123176.349344F-00 Hu(10) = .35123176.349347F-00 Hu(10) = .512690.53404647F-00 Hu(10) = .512690.53404647F-00 Hu(10) = .940675.21764764F-00 Hu(10) = .940675.21764764F-00 Hu(10) = .940675.2176477F-00 Hu(10) = .940675.2176477F-00 Hu(10) = .4406114-10 Hu(10) = .4406114-10 Hu(10) = .4406114-10 | 1'0 kHu((9) = .0 4Hu((10) = .317444114149544F-00 4Hu((10) = .312431743434F-00 4Hu((10) = .312431743434F-00 4Hu((11) = .31269153404647F-00 4Hu((13) = .657671159216691E-00 4Hu((13) = .657671159216691E-00 4Hu((13) = .657671159216691E-00 4Hu((14) = .4806234153726946E-00 4Hu((15) = .99067542769164F-00 4Hu((17) = .9906754274917F-00 175 1=1.44 | 1'0 kHu(9) = .0 4Hu(10) = .3184441H1495H4F-00 4Hu(110) = .318491H495H4F-00 4Hu(110) = .31849H4F-00 4Hu(110) = .31849H4F-00 4Hu(110) = .31849H4F-00 4Hu(110) = .31849H491F-00 4Hu(110) = .31849H491F | | 067 01 05 | | |
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| 175 | KHU (14) = .6916870434603536-00. | CULPNI | 176 | |
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| 190 | xC(1) = x(1) | COLPNI | 161 | |
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| | XC(1) = X(1) | COLPNI | 202 | |
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| | IF (XVAL .GT. 0.0) XL = XNE# | COLPIN | 217 | |
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| | METHODS AND O TON THE OTHER METHODS. LABY - I HENDER | 2111 |
| | IS THE MAXIMUM ORDER AVAILABLE. SEE SUBROUTINE COSET. | HT 41 15 |
| | Y(1,J+1) CONTAINS THE J-1H DERIVATIVE OF Y(1). SCALED HY | STIFIB |
| | Heal/FACTORIAL (J) () () () () | STIFIE |
| 2 | A CONSTANT INTEGER OF A LISTO FOR DIRENSIONING PURPOSES. | STIFTH |
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| | PROBLEM. H CAN BE EITHER POSITIVE OR NEGATIVE. HUT 115 | STIFIH |
| | SIGN MUST PEMAIN CONSTADT THROUGHOUT THE PROBLEM. | STIF IH |
| HMI1. | THE MINIMUM AND MAXIMUM ANSOLUTE VALUE OF THE STEP SIZE | STIF 1H |
| HMAX | TO BE USED FOR THE STEP. THESE MAY HE CHANGED AT ANY | STIFIE |
| | TIME. BUT WILL NOT TAKE FFFECT UNTIL THE NEXT H CHANGE. | STIFIE |
| EPS. | THE RELATIVE EKHOR HOUND. SEE DESCHIPTION IN PIDECUL. | STIFIH |
| | 3 | STIFIH |
| | THE NUMBER OF FIRST-ORDER JIFFERENTIAL EQUATIONS. | STIFIE |
| | THE METHOD FLAG. SEE DESCRIPTION IN POFCOL. | STIFIE |
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| | STEP. AND H IS THE LAST STEP SIZE ATTEMPTED. | STIFIE |
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| C EMPOR AN ARRAY OF N TLEMENTS. PHOMENJOID IS THE FSTIMATED | ONE-STEP EMOR IN Y(1). | PW A BLOCK OF LUCATIONS USEU FOR THE CHURU IT | | | ML+MU 1H | | #UPK • I WORK | C ARRAYS TO OTHER SUPPOUTINES. | | PACKAGE ROUTINES CALLEU. | DOCK FOUTINES CALLED. | | USED. AUSTAMAKI . AMINI . | | ************************************** | CANCEL AND THE CONTRACT OF THE PARTY AND THE CONTRACT OF THE C | CONTROL VINE TO THE TANK THE T | | LEGISTON OF TAXABLE STATES OF THE STATES OF | COMMON/GENDY/FDS/Lock - Milenselle - NOMILE - NO | CUMMON /GEARD/ HUSEU.NOUSED.NSTEP.NFE.NJE | COMMON/GEAPS/HMX | COMMON JUPTION/ NUGAUS, MAXIER | COMMON/TARSM/SMALL | DIMENSION EL(13) + Tu(4) | DATA EL (21/1./ OLULU/1./ TUTI)/0./ IEH/U/ | KFLAG = 0 | | .6T. 0) 6U TO | IF (JSTART .NE. 0) 60 TO 120 | | C ON THE FIRST CALL. THE ORDER IS SECTION! AND THE INTITIAL YOUT IS | THE STANSIF OF | - | | C FUR THE NEXT INCREASE. | 1 | CAR CAR CONFINANCE TO YOUNG TO THE KODE OF THE CORE OF THE CARDEN OF THE | IF (IFK - NE. 0) 60 TO 6H5 | Z | | - M/1 | ATTER B AF . 10 that It | , | | | | |
| | 99 | | | | 45 | | | | | 20 | | | | ļ | C | | | | 9 |) [| | | | H5 | | | | | 06 | | | | Ş | | | | 40. | | | | 105 | | | | 91 | 110 | 011 | 011 |

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| OPT=1 HOUND=+-#/ IMACE |
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| | SUHHOUTINE | STIFIH 76/76 OPT=1 KOUND=+-4/ [:ACE FIN 4.8+45H 0 | 04/17/40 | 11.10.37 |
|----|------------|---|--|---|
| | 115 | MF OLD = MF NOLD = N NSFEP = 0 NSFEP = 0 | 571F18 571F18 571F18 571F18 | 2111 7111 19 |
| | 150 | ~ ~ ~ ~ ~ ~ | | 123 123 |
| | ç21 | C.T. THE COLLER HAS CHANGED METH, CUSE! IS CALLED TO SET C.THE LUEFFICIENTS OF THE METHOD. IF THE CALLER HAS CHANGED C.N. E.PS. OH METH. THE COUSTANTS & EDM. & EUM. AUD HND MUST HE RESET. C. F. IS A COMPARISON FOR EMPOYS OF THE CURRENT OWNER NO. EUP. EUP. | 571F18 571F18 571F18 571F18 | 125 125 127 128 |
| | 130 | TO TEST FOR INCREASING THE UNDER HAD IS USED TO TEST FOR CONVENGE IF THE CALLER HAS CHANGEU H, Y M IF H UN METH HAS HEEN CHANGED. I FURTHER CHANGES IN M FOR THAT MA | STIF1H STIF1H STIF1H STIF1H | 130 |
| | 135 | METH MITFE | STIFIE STIFIE STIFIE STIFIE | 13465 |
| 94 | 140 | MILEM # MP = 10*MEIR MFOLD = MF IF (MITEM • NE. MIU) IMEVAL = MILER If (METH • FG. MEG) 60 TO 150 IDOUR = L • 1 IDOUR = 1 | STIFIB STIFIB STIFIB STIFIB | 70 C C C C C C C |
| | 145 | 130 CALL COSET (METH. NU. EL. TQ) LMAX = MAXDER + 1 HC = RC*EL!1)/OLULO OLULO = EL(1) 140 FN = FLOAT(N) | STIFIE STIFIE STIFIE STIFIE | 100 100 100 100 100 100 100 100 100 100 |
| | 150 | EUN = FN*(TQ(1)*FPS)**? E | ST 15 18 ST 15 18 ST 15 18 ST 15 18 | 150 151 153 154 154 |
| | 551 | FPSOLD = FPS | STIFIE | 251 751 851 951 |
| | 150 | 1 | S11713 S11714 S11714 S11714 | 164 164 164 164 |
| | 541 | 170 FF = AMINICHIMMIN AFSCHI) 175 FF = AMINICHIMMAX AFSCHI)+MAX) FF = AMINICHIMMXX AFSCHI)+MAX) FF = 1. FF = 1. | STIFIE STIFIE STIFIE STIFIE | 55 56 56 56 56 56 56 56 56 56 56 56 56 5 |
| | 170 | | 511F1R 511F1R 511F1R | 171 |

| SUHROUTINE STIFIE | ST1F1H | 76/76 | | OPT=1 KOUND=+-*/ IMACE | ÷ | ⊬ A CŁ | <u>z</u> | FIN 4.449H | 04/15/80 11:10.37 | 11.10.37 |
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| 541 | н = н*кн кс = кс*кн 1000в = L 1F (1REDO | н = н*кн кс = кс*кн 1000в = L + 1 16 (1REDO , EQ | 60. | н = н*кн кс = кс*кн 100uв = L + 1 1F (1kEbu .Eu. 0) 6u Tu 690 | • | | | | STIFIE STIFIE STIFIE | 173 174 175 176 |
| 1 א 0 | C THIS SECTI C MULTIPLYIN C PC IS THE C WHEN PC DI | LON COMPI SO THE Y KATTO OF IFFEHS FI | UTES AKKA F NEW HOM I | THE PREDIC Y HY THE P TO OLD VA HY MORE T | TED YASCHE HAN | CTHIS SECTION COMPUTES THE PREDICTED VALUES BY EFFECTIVELY C MULTIPLYING THE Y ARMAY BY THE PASCAL TRIANGLE MATHIX. C RC IS THE MATHO OF NEW TO VALUES OF THE COEFFICIENT H*ELID. C WHEN HC DIFFERS FROM I BY MORE THAN 30 PERCENT OF THE CALLER HAS C CHANGED MITER. LAFVAL IS SET TO MITER TO FORCE PW TO HE UPDATED. | ECTIV 1917 1016 1016 10 9 | FLY IT H*L(1). CALLE HAS | 51112 51113 51113 51113 51113 51113 | 178 179 181 181 |
| | | CHOPD I | S UPD TERAT | ALED AT LE | A 5 1 . | IN ANY CASE, PW IS UPDATED AT LEAST .VERY 40-TH STEP. PW IS THE CHORD ITERATION MATHIX A - H*EL(I)*(U6/UY). | 1£P. UY) - | | STIF 14 STIF 14 - STIF 14 | 1.83 1.84 1.85 |
| 145 | 200 IP (AMS(RC=1.) .61. 0.3) IMEVAL = MITEX IF (WSTEP .66. NSTEPJ.40) IWEVAL = MITEX I = I + H UO 210 J1 = 1.NO UO 210 J2 = J1.NU | 1F (AHS(RC-1.) .61 (NSTEP .6E, NSTE) 1 = 1 + H UO 210 J1 = 1.NO UO 210 J2 = J1.NO | NST. | IF (AMS.RC=1.) .61. 0.3) IMEVAL = MITEM IF (WSTEP .GE, NSTEPJ.4.40) IWEVAL = MITEM I = 1 · H UO 210 J1 = 1.NO UO 210 J2 = J1.NU | E VAL IE VAL | H H Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z Z | | | STIFIE STIFIE STIFIE HIST | 2444 |
| 190 | J = D0 Z 210 Y { 220 CONTINUE 220 IF (1MEV) | J = (NG + J1) - J2 DO 210 I = 1+N Y(I+J) = Y(I+J) INUE IMPUE - LE 0) GU | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | J = (NO + JI) - J2 $DO 210 I = I+N$ $V(I+J) = V(I+J) + V(I+J+I)$ $V(I+J) = V(I+J)$ $V(I+V) = V(I+J+I)$ $V(I+V) = V(I+J+I)$ $V(I+V) = V(I+J+I)$ | ÷ - | | | | STIFIH STIFIH STIFIH STIFIH | 191 192 194 195 |
| ç61 | C IF INDICATED. THE C CURRECTOR ITERATION THE THIS HAS HEEN | TED. THE ITEPATIC HAS REEN | N DON | IA PW IS H IWEVAL IS E. PW IS | SET 1 | C IF INDICATED, THE MATRIX PW IS REEVALUATED HEFOWE STARTING THE C CUMPECTOR ITERATION. IMEVAL IS SET TO 0 AS AN INDICATOR C CHAT THIS MAS HEEN DONE. PW IS COMPUTED AND PROCESSED IN PSETIM. | STAR | 11 NG 14F 00A 1 N PSE 11H • | | 197 197 198 199 |
| 200 | | IMEVAL = 0 HC = 1. NJE = NJE + 1 NSTEPU = NSTEP | a ~ | | | | | | STIFIH STIFIH STIFIH STIFIH STIFIH | 202 203 204 204 |
| 205 | CALL P | SETTH C | A DA | * NO. CON. | Ξ | CALL PSETIN (Y. Pw. NO. CON. MITCH. IEM. WORK (INI). IMOPR. | | DSETTS (Y. PW. 100. CON. MILT. R. IER. WORK(INI). IMOPK. | STIFIA | 206 |

| 205 | CALL PSETIG (Y. Pw. 10. CON. MITH. TER. WORK(IWI). IMOPK. | STIFIH | 206 |
|-----|---|----------|------------|
| | * NOTE (IES) **SAVE <- ITIO*********************************** | STIFIH | 207 |
| | * NORR (IMIN) * NORR (IMIN) * NORR (IMIN) * NORR * | STIFIB | 208 |
| | IF (IER .NE. 0) GO TO 420 | STIFIH | 509 |
| | 350 CONTINUE | STIFIH | 210 |
| 012 | | STIFIH | 211 |
| | CC UP TO 3 CORPECTOR ITERATIONS ARE LAKEN. A LUNVEMOENCE TEST IS | ST IF IH | 212 |
| | CC MADE ON THE M. M. S. RORM OF EACH COMMECTION. USING HND. WHICH | STIFIH | 213 |
| | | STIFIH | 214 |
| | | STIFIH | 215 |
| 715 | _ | STIF IH | 216 |
| | | ST 1F 1B | 217 |
| | | S11f1k | 218 |
| | 70 230 1=1 0E2 0O | STIFIB | 219 |
| | SAVF2(1)=Y(1.2) | STIFIH | 220 |
| 220 | SAVE1(1)=Y(1•1) | STIFIE | 221 |
| | 230 EHOR(I)=0.0 | ST 11 1H | 255 |
| | ZIIZ | STIFIH | 723 |
| | 340 11=0 | STIFIE | 466 |
| | DO 345 K=1 •4PH | ST IF IH | 225 |
| 225 | ST (X + 1) * SCC + 15 + 1. | STIFIH | 37.0 |
| | 1End=Kenco1s | 711F 13 | 177 |
| | 171=(1-1) 010 | EI 31 15 | 300 |
| | CALL INFS (T+M+SAVE,1+SAVESAVE) 3+++1)E+14(P1S+WI)KK (141)+1WI)KK+ | 51 IF IH | 667 |
| | | | |

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| 230 | * SOPR*BORK([#14] ** ** ** ** ** ** ** ** ** ** ** ** ** | STIFIH STIFIH |
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| | THE LINEAR SENT MATRIX. | STIFIE STIFIE STIFIE |
| et. | C 00 E 00 E E | 511518 511518 511518 511518 |
| 540 | 38U SAVE1(1) = Y(1-1) + EL(1)*EHHP(1) 38U SAVE2(1) = Y(1-2) + EHOP(1) RS CUNTINUF NF = NF E-1 | STIFIE STIFIE STIFIE STIFIE |
| 545 | C TEST FUR CONVERGENCE. If M.GT.O. ALL ESTIMATE OF THE CONVERGENCE C RATE CUNSTANT IS STOKED IN CHATE. ALL THIS IS USED IN THE TEST. | STIFIH STIFIH STIFIH |
| | 400 IF (M .NE. 0) CHATE = AMAXI(., 4 CKATE.)/UL) IF ((D*AMIN)(1.0E0.2.*CHATE)).LE.:ND) GU TO 45 | STIF 18 STIF 18 |
| | U1 = U M = M + 1 IF (M .EQ. 3) GU TU 4.10 GU TU 360 | ST17118 ST17114 ST17114 |
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| 260 | CONTINUE INEVAL=MITER 20 T = TOLO HMAX = 2. | 811518 811518 811518 811518 |
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| 275 | THE COMPECTOM MAS CONVENCED. IMEVAL IS SET TO -1 THAT PW MAY NEED UPDATING ON SUBSECUTIVE STEPS. THIS MADE AND CONTROL PASSES TO STATELLING SOO IF IT | STIFIE STIFIE STIFIE |
| 280 | 450 IWFVAL = -1 0 = 0. 00 460 I = 1.N 450 D = 0 • (EHROM(I)/ΥΜΑΧ(I))*°°/ 1F (O .6f. E) (O I) 200 | ###################################### |
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| 300 | UO 470 J = 1.L UO 470 J = 1.N 470 Y (1.2.) = Y(1.J) + EL(J)*EMMUM(I) IF (T.2.0.0+M.GT=TUOU) I UOUB*I I UOUB=IUOUR+M | STIFIH STIFIH STIFIH STIFIH STIFIH | 000 000 000 000 000 000 |
| 305 | <pre>IF (100UB .EQ. 1) GO TO 520 IUOUB = IDOUB - 1 IF (IDOUB .GT. 1) GO TO 700 IF (L .EQ. LMAX) GO 10 700 UQ 490 I = 1 \ndots 490</pre> | STIFIE STIFIE STIFIE STIFIE STIFIE STIFIE | 305 306 308 309 310 |
| 310 | GO TO 700 ERHUR TEST FAILED. KFL TURE T AND THE Y ARHAY T THY THE STEP AGAIN. COM | STIFIE STIFIE STIFIE STIFIE STIFIE | 313 313 316 316 316 |
| 320 | 500 KFLAG = KFLAG - 1 1 = 10LD 510 J1 = 1+N ¹ 510 J2 = J1+N ¹ 510 510 J2 = J1+N ¹ 510 510 J2 = J1+N ¹ 510 510 J2 = J1+N ¹ | | 325 320 321 322 323 |
| 325 | 510 Y(1.J) = Y(1.J.) - Y(1.J.) HMAX = 2. JF (AFSA) .LE. HMIN*1.U0001) (44 TO 65U IF (KFLAG .LE3) GU TO 640 IMEDO = 2 ENUZ=.5/FLOAT(L) | STIFIE STIFIE STIFIE STIFIE STIFIE | 326 326 327 328 |
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| 510 1000H=3 6.0 TO 100H=3 6.0 TO 7 FALLOWER STATE HOW LE AND 10 610 5.1 FIRE IS A CHANGE OF OURER, WEST 100, L. AND 10 610 5.1 FIRE IS A CHANGE OF OURER, WEST 100, L. AND 10 FIRE STATE HOW 690 IF THE STEP WAS ON. OF NEUDO THE STEP OTTH PWISE. 5.1 FIRE STATE FROM 690 IF THE STEP WAS ON. OF NEUDO THE STEP OTTH PWISE. 5.1 FIRE STATE FROM 690 IF THE STEP WAS ON. OF NEUDO THE STEP OTTH PWISE. 5.2 NO NO = NEWO C. = NO * 1 L. = NO * 1 STIFTH C. COUTHOUR READERS THIS SECTION IF 3 10 MONE FAILUMES HAVE OCCUPED. 5.1 FIRE 5.1 FIRE 5.1 FIRE 5.2 SANWED THAT THE URHIVATIVES HAT HAVE ACCUMULATED IN THE 5.2 COUTHOUR READERS THIS SECTION OF 3 10 MONE FAILUMES HAVE OCCUPED. 5.1 FIRE 5.2 COUTHOUR READERS THIS SECTION OF 10 MONE FAILUMES HAVE OCCUPED. 5.1 FIRE 5.2 COUTHOUR READERS THIS SECTION OF 10 MONE FAILUMES HAVE OCCUPED. 5.1 FIRE 5.3 FIRE 5.4 COMMON OF 10 MONE FAILUMES AND HE STEP IS PETHIED. 5.4 FIRE 5.5 FIRE 5. | | 60 10 630 | STIFIH | 373 |
| 5.11 | | | STIFIH | 37. |
| CONTROL REACHES THIS SECTION IF 3 OF MORE FAILURES MAYER OCCURED. C. IF THEME IS A CHANGE OF OUDER, MESEL 101, L. AND THE COEFFICIENTS. C. IN ANY CASE H IS RESET ACCORDING TO 44 AND THE COEFFICIENTS. C. THEN EXIT FROM 690 IF THE STEP WAS CO., OR REDO THE STEP OTHEWAIS. C. THEN EXIT FROM 690 IF THE STEP WAS CO., OR REDO THE STEP OTHEWAIS. C. THEN EXIT FROM 690 IF THE STEP WAS CO., OR REDO THE STEP OTHEWAIS. STIFTH C. THEN EXIT FROM 690 IF THE STEP WAS CO., OR REDO THE STEP OTHEWAIS. STIFTH C. THEN EXIT FOR WAS CO. TO TO TO TO TO THE STEP OTHEWAIS. STIFTH C. CONTROL REACHES THIS SECTION IF 3 OF MORE FAILURES HAVE OCCURED. STIFTH C. TAMAY HAVE FROMS OF THE WRONG OFFIRE HEAVE OCCURED. C. THEN EXITED THE WRONG OFFIRE HEAVE COCCURED. STIFTH C. THEN EXIT FOR THE WRONG OFFIRE HEAVE OCCURED. STIFTH C. THEN EXIT FOR THE WRONG OFFIRE HEAVE OCCURED. STIFTH C. THEN EXIT FOR THE WRONG OFFIRE HEAVE. C. THEN EXIT FOR THE WRONG OFFIRE H | | | STIFIB | 37 |
| C. THEN EXIT FROM 690 IF THE STEP WAS OR. OF PEUD THE STEP OTHER IS A CHANGE OF OWNER, PESET TO THE STEP OTHER IS. C. THEN EXIT FROM 690 IF THE STEP WAS OR. OF PEUD THE STEP OTHER IS. C. THEN EXIT FROM 690 IF THE STEP WAS OR. OF PEUD THE STEP OTHER IS. STIFTH SAY WAS THE STEP WAS OR. OF PEUD THE STEP OTHER IS. C. COUTHOL REACHES THIS SECTION IF 3 0° MOME FAILUMES HAVE OCCUPED. C. T. I.S. ASSUMED THAT THE DEMINATIVES IN AT HAVE FIRST C. OF THEN AND FEMUNES OF THE STEP IS SET IN A STIFTH STIFTH C. C. T. T. SAY WAS THAVE FROM OF 10° AND THE STEP IS SET IN A STIFTH STIFTH C. C. T. T. T. SAY WAS THAN STIFTH OF THE STEP IS SET IN A STIFTH C. C. T. T. T. SAY WAS THAN STIFTH OF THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REP A TOTAL OF T FAILUMES. AND THE STEP IS SET IN A STIFTH C. C. AT REACHES. AND THE STEP IS SET IN A STIFTH C. C. T. | 375 | U IF ((KFLAG .EG. 0) .AND. | STIFIE | 376 |
| C IF THEME IS A CHANGE OF OPDER, RESEL 400, L. 4 AND THE COEFFICIENTS. C IN ANY CASE H IS RESET ACCORDING TO 4H AND THE Y AWRAY IS PESCALED. C IN ANY CASE H IS RESET ACCORDING TO 4H AND THE Y AWRAY IS PESCALED. C IN END 600 IF THE STEP WAS COR, ON PEDDO THE STEP OTHERWISE. SITE IN STIF IN | | | STIFIH | 37 |
| C THEN EXIT FHOM 690 IF THE STEP WAS CHE, OF PEUO THE STEP OTH FM154. C THEN EXIT FHOM 690 IF THE STEP WAS CHE, OF PEUO THE STEP OTH FM154. STIFTH F (NEWY FG, NUT) 60 TO 170 L = NU + 1 STIFTH STIFTH STIFTH STIFTH STIFTH C COUNTED THIS SECTION IF 3 Us MONE FAILUNES MAVE OCCUPED. STIFTH C TARKAY HAVE EXPUDED UF THE UNITITY STIFTH C TARKAY HAVE EXPUDED UF THE UNITITY STIFTH C TARKAY HAVE EXPUDED OF THE WHOMO OWN HE MAY COUNTED. C AFTER A TOTAL OF T FAILUNES. AN EXIL IS TAKEN WITH KELAGE = -2. STIFTH C A MANAY HAVE STIF | | C IF THEME IS A CHANGE OF UNDER! MESET 40: L. AND THE COEFFICIENTS. | ST 1F 1H | 37 |
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| GO TO 130 C. CUATHOL, REACHES THIS STOTION IF 3 U. MORE FAILURES MAVE OCCURED. STIFTH C. CUATHOL, REACHES THIS STOTION IF 3 U. MORE FAILURES MAVE OCCURED. STIFTH C. T A MARAY HAVE FYRDILE. C. Y ARMAY HAVE FYRDILE. C. OEKIVATIVE IS PECOMULIA. AND THE UNITH IS SET TO 1. THEN STIFTH C. OEKIVATIVE IS PECOMULIA. AND THE UNITH IS SET TO 1. THEN STIFTH C. OFFICED BY A FACTOR OF 10. ATM THE STEP IS PETMIED. C. AFTER A TOTAL OF 7 FAILURES. AN EALT IS TAKEU WITH KELAG. = -2. STIFTH C | | 1 - 1221 | 7116117 | 2 |
| C CUTIMOL REACHES THIS SECTION IF 3 0° MORE FAILUNES HAVE OCCUPED. C TI IS ASSUMED THAT THE URIVATIVES HAR HAVE, ACCOMMILATED IN THE STIFTH COMMINATIVE IS PECOMMULE. AND THE WOOLD WAR IS FIT IN THE STIFTH COMMINATIVE IS PECOMMULE. AND THE WOOLD WAR IS SET TO 1. THEN STIFTH COMMINATOR OF 10, ARU THE STEP IS PETHIED. C AT FEW A TOTAL OF 7 FAILUNES, AN EXIT IS TAKED WITH KELAG. = -C. STIFTH STIFTH COMMINATOR OF 10 570 H = AMAX] (HMIN/ AUS(H), WH) STIFTH STIF | 7 # C | (a) 10 130 | STIFIE | . . |
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| C Y ARRAY HAVE FRRUKS OF THE WOOD OF H.R. HENCE THE FLAST C DERIVATIVE IS PECOMPUTED. AND THE OF HR IS SET TO 1. THEN C H IS PEDUCED BY A FACTOR OF 10. AND THE STEP IS PETHED. C AT EFF A TOTAL OF FAILURES. AN EALT IS TAKEN WITH KFLAG = -r. C | | C IT IS ASSUMED THAT THE DERIVATIVES IMAT HAVE ACCUMULATED IN THE | H14115 | Ĭ |
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| SUBROUTINE EVAL (ICPT+NPDE+C+UVAL+A+ILEFT) | | f VAL | ~. |
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| C PACKAGE ROUTINES CALLED NOME | | EVAL | 12 |
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| CUMPON/S12ES/NINTOKUMDO 10UM 12) LPTS ONE UNO 1 UUAU | | EVAL | <u>4</u> |
| IN = ILEFT(ICPT) - NURD | | EVAL | 61 |
| IC = 30KORU0(ICP1-1) | | EVAL | 20 |
| DU 10 M=1.3 | | EVAL | 21 |
| ICC = IC + KOKIP (H-1) | | EVAL | 22 |
| UO 10 J=1+NPDE | | EVAL | 23 |
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| UVAL (J.M) =UVAL (J.M) +C (JC+I+IK) +A (I+IC) | | EVAL | 27 |
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| s | C THIS ROLLING COMPUTES YELD # A(Y.1) 00-1 4 G(Y.1) HY USE OF | DIFFUN | ·c |
| • | C THE MOUTINES GETW. ADDA. DECH. AND SOLB. | DIFFUN | _ |
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| 20 | Š | DIFFUN | 2 |
| į | CALL GFUN(T.Y.YDDT.NPDE.NCPIS.WU-K(INI).*OKK.WUK(INI4). | DIFFUN | 22 |
| | * TOXX (IEIS) * SOXX (IEIS) * SOXX (IES) * SOXX * (IES) * IEOX * X * X * X | DIFFUN | 23 |
| | | DIFFUR | 5 % |
| | 1ST = (x-1) + (CPTS+) | DIFFUN | 25 |
| ኢ | CALL ADDA (PA(NSI) • ACPIS• BORK (I41) • IBORK • WORK • NPDE • K) | DIFFUN | 5 6 |
|) | CALL DECB(NCP1S.NCP1S.ML.+HU.PP4(151) + IP1V(151) + IEA) | DIFFUN | 23 |
| | | DIFFUN | 28 |
| | CALL SOLB(NCPTS-NCPTS-ML-MU-PW(N-T)-YDDT(1ST) - 1P1V(1ST)) | DIFFE | 52 |
| | 20 CONTINUE | DIFFUN | 30 |
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| SURFOULINE AUD | SUBBOUTINE ADDA (Parino at ILET 1.5) TOPOE TATOE | 4004 4004 |
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| C CALLING ARGUMENTS | C. CALLING ARGUMENTS AME UEFINEU HELOW AND IN PURCIL AND STIFTS. | 4004 4004 |
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| C SUBHINUTINE ADDA AD | SUBBLOUTINE ADDA ADDS THE MATRIX A TO THE MATRIX STURED IN PER IN | AUUA |
| C HAND FURM. PW IS | PW IS STURED BY DIAGONAL'S WITH THE LOWERMOST DIAGONAL | AUUA |
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| DIMENSION DAIN | DIMENSION DE (NO.1).A(1).ELEF1(1).BC (NPDE.4) | AUUA |
| COMMON /SIZES/ | COMMON /SIZES/ NINT-KOFD-NCC-NP:-NCPTS-NEUN-1UAU | AUUA |
| | | - ADUA |
| C AUD THE HOUNDARY C | C AUD THE HOUNDARY CONDITION PURTIONS OF THE A MATRIX TO PW (THE FIRST | |
| CC AND LAST ROWS) . | | AUUA |
| | *************************************** | - AUDA |
| 1COL = 1LEF T(1) + 1 0UAU-1 | J UUAU-1 | AUUA |
| PW(1.1COL)=PW(| PW(1.1COL)=PW(1.1COL)+8C(KPUL.1) | ADUA |
| P#(1.100[.1) =P | P#(1-1COL+1) #P#(1-1CUL+1) +BC(*P** -2) | ADUA |
| P# (NCP15+1CUL- | P# (NCP15+1COL-1) =P# (NCP15+1COL-1)+HC (KP1)E+3) | AUUA |
| PW (NCPTS+ ICOL) | P# (NCPTS+ICOL) #P# (NCPTS+ICOL) +HC (KPDE+4) | ADUA |
| () | 76 55 PP 65 65 65 65 65 65 65 65 65 65 65 65 65 | - AUDA |
| C UPDATE THE REMAINING ROWS OF | NG ROWS OF PW BY ADDING THE APPROPRIATE VALUES | ADOA |
| C IN A TO PW. | | AD:JA |
| | | - ADDA |
| IND # NCPTS : | | ADIOA |
| DU 20 1±2.1% | | ADOA |
| 12 = (I-1) + KORD | KORD • 3 | ADDA |
| 1COL = 1LEFT(1) - | (1) - 1 + 10UAD - 1 | AU0A |
| UC 20 JEJ-KOKO | | AUOA |
| J=1COL+1 | | ADDA |
| (+ 21 = 20 | | ADOA |
| 20 Pw([-J])=Pw([-J])+A(J2) | J1) +A (J2) | AUCA |
| | | ADUA |
| | | |

| | SUBPOUTINE RES(T.H.C.V.K.NPDE.HC. | 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 | ∾ m √ |
|----------|--|---------------------------------------|--------------|
| i | C CALLING AMGUMENTS ARE DEFINED MELUW AND IN POLCOL. | | * W · |
| v | C SUBROUTINE RES COMPUTES THE RESIDUAL VECTOR M = H*G(C.T) - A(C.T)*V | ድ | c ~ |
| | WHERE H IS THE CURRENT TIME STEP SIZE 6 IS A VECTOR A IS | KES | ac. |
| | Ĭ | RES | • |
| | CC ONLY THE PART OF A COMMESPONDING TO THE K"TH PUE IS CALCULATED | KES | 2 |
| 2 | CC IN A SINGLE CALL TO MES. | 2 L | = = |
| | C DACKAGE DOUTINES CALLED. GFILM | . v | <u> </u> |
| | USER ROUTINES CALLED. | 표 | 2 |
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| 15 | FUHTHAN FUNCTIONS USED NOVE | KF.S | 91 |
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| 2 | | 25.5 | 2 |
| | C FURM THE FIRST AND LAST BLOCK RUMS OF THE RESIDUAL VECTOR | KES | æ |
| | C WHICH ARE DEPENDENT ON THE HOUNDARY CONDITIONS. | PES | 5 |
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| | 15T= (K-1) •NCPTS+1 | FFS | ~ |
| | I ENDER CPTS | ÆS | 33 |
| | SUM]=BC(K+1)+V(IST)+BC(K+2)+V(I>1+1) | RES | Ž. |
| | SUM2=6C(K+3)+V(1END-1)+BC(K+4)+v(1END) | RES | |
| ¥ | K(1ST) #H*R(1ST) - SUM1 | KES | 9 |
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| FORTIAL BY: | FORTIAL DISTRICTIONS USED. STATE | DATE OF THE STREET | 2000 | 9 |
| FORTRAN F UNCTIONS USED. | FORTIAN F UNCTIONS USED. | CALLED BY | 725 116 | 7 |
| UIMENSION PW(I) *C(I) *CMAX(I) *UVAL(N*UE*3) *SAVE?(I) * IP IV (I) PSETIH UIMENSION PW(I) *C(I) *CMAX(I) *UVAL(N*UE*3) *SAVE?(I) * IP IV (I) PSETIH UIMENSION DEDUCKPUE) *OF UUXX (N*UE) *PSETIH UIMENSION DEDUCKPUE) *OH UUXX (N*UE) *PSETIH COMMON /SIZES/ NINT**(ORD**NC**N*U**NUM**NOM! *OF UUX (N*UE) *PSETIH COMMON /SIZES/ NINT**(ORD**NC**N*U**NOM! *OF UUX**(ORD**NC**N*U**NOM! *OF UUX**(ORD**NC**N*U**NOM! *OF UUX**(ORD**NC**NOM! *OF UUX**(ORD**NC**NOM! *OF UUX**(ORD**NOM! *OF UUX**(OR | UIMENSION PW(I) * C(I) * CMAX(I) DIMENSION DEDUCAPLE) * OF UDX (NPUL * O. DEDUX (NPUL * O. DEDU | FUKTHAN FUNCTIONS USED. | PSE T 1H | 2B |
| DIMENSION PW(1).c(1).c(MAX(1)) DIMENSION A(1).1LEFT(1).b(C(1).A((1).UVAL(NPUE.3).SAVEZ(1).IPIV(1)) DIMENSION A(1).1LEFT(1).b(C(1).A((1).UVAL(NPUE.3).SAVEZ(1).PIV(1)) DIMENSION DEDUT(MPUE).c(DUXX(MPUE.) DIMENSION DEDTT(MPUE).c(DUUX(MPUE.) DIMENSION DEDTT(MPUE).c(DUUX(MPUE.) COMMON/GEARL/STES.A INIT:ACROBIO.C(C.NPU.) DO 10 I=1.0004 DO 20 I=1. | DIMENSION PW(1) = C(1) = CMAX(1) DIMENSION A(1) = LEFT(1) = BC(1) = L(1) = L(1 | | PSE TIH | 67 |
| DIMENSION A(1)*ILEF T(1)*BC(1)*AL(1)*UAL(NPUE*3)*SAVEP(1)*IP IV (1) PSETIB UNMENSION DEDUCTORPED.*OFBUUX KINPUE*) UNMENSION DEDT (NPUE*)*OBBUUN KNPUE*) COMMON /SERRY/PEDE*,*OBBUUN KNPUE*) COMMON /SERRY/FES*,*IN **IN **IN **IN **IN **IN **IN **IN | DIMENSION A(1)*ILEFT(1)*BC(1)*AL(1)*UAL(NUE) **SAVEP(1)*IP IV(1) PSETIB UNMENSION DEDUCKUPE **OFBUXKINPLE) UNMENSION DEDUCKUPE **OFBUXKINPLE) UNMENSION DEDUCKUPE **OFBUXKINPLE) COMMON /SIZES/ NINI*KURD*NCC*NPU**NCPTS*NLUN*IUAU COMMON /SIZES/ NINI*KURD**NCC*NPU**NCPTS*NLUN*IUAU COMMON /SIZES/ NINI*KURD**NCPTS*NLUN*IUAU COMMON /SEATI/ T**H**UUMMY(3)*UNUU**NUMU DO 10 1=1*NO** DO 10 1=1*NO* | CHEENSION FE(1) . C(1) . CMAX(1) | PSETIH | 30 |
| UIMENSION DEDUCKUPDE) ************************************ | UIMENSION DEDUCKAPUE) • UF DUX (NPUE) • DF DUX (NPUE) DIMENSION DEDUCKAPUE) • UF DUX (NPUE) • UF SETTH COMMON / SIZES / NILL ** NUME ** NU | DIMENSION A(1) «ILEFI(1) «BC(1) «AC(1) «UVAL (NPUE «3) «SAVE? (1) « IPIV(1) | PSETIB | 33 |
| DIMENSION DEDT(HDDE) **HBDUX(NPDE) COMMON /SIZES/ NINT*KORD**NC**N**N**LUN**IQUAD COMMON /SIZES/ NINT*KORD**NCC**N**N**LUN**IQUAD COMMON /SIZES/ NINT*KORD**NCC**N**N**INOM**NOM! COMMON/GEARP/FPSJ**RO**ML**MU**MU**MU**NUM**NOM! DD=0.0 DD=0.0 IEND**R**NCPIS* OU 20 I=IST**K**N UU 20 III III III III III III III III III | DIMENSION DEDT(HDUE) **DBDU(NPDE) **HBDUX (NPDE) **DBBUX (NPDE) **DBBUX (NPDE) **DBBUX (NPDE) **DBBUX (NPDE) **DBBUX (NDDE) ** | LIMENSTON DEDINATION - DETRIKE (NPDF) | PSFTIN | 2 |
| COMMON / SIES / NINTER DESCRIPTION OF STRUCTURE DESCRIPTION OF STRUCT | COMMON_GEARY_CES_ VENDO-NCC_NET_NOW_NOW_ COMMON_GEARY_CES_ VENDO-NCC_NET_NOW_NOW_ COMMON_GEARY_CES_ VENDO-NCC_NET_NOW_NOW_ COMMON_GEARY_CES_ VENDO-NCC_NET_NOW_NOW_ COMMON_GEARY_CES_ VENDO-NC_NET_NOW_NOW_ COMMON_GEARY_CES_ VENDO-NC_NET_NOW_NOW_ DO 10 1=1,NOM DO | CONTRACTOR OF THE CONTRACTOR O | 21.100 | ; ; |
| COMMON / SIZES / NIN 19 CONTROL 10 COMMON / SIZES / NIN 19 COMMON / SIZES / | COMMON_CEARLY T.++.UUMMY(3).CHRUNDLANT(3) COMMON_CEARLY T.++.UUMMY(3).CHRUNDLANT(3) COMMON_CEARLY T.++.UUMMY(3).CHRUNDLANDLANDLANDLANDLANDLANDLANDLANDLANDLA | UNENSION DECLINATION ACCOUNTS AND ACCOUNTS A | 1751 | ? ? |
| COMMON_/GEARI/ T.+H.DUMMY(3) .URCULD.NN.IDUMHY(3) CUMMON_/GEAR9/EPSJ.*RO.ML.*MU.*WW.*NMI.*NUML.*NUW.*NOWI CUMMON_/GEAR9/EPSJ.*RO.ML.*MU.*WW.*NMI.*NUML.*NUW.*NOWI DU 10 1=1.NOP CALL GFUN(1.C.SAVE2.14PDE.NCPTS.*A.*HC.*DUDU.*UBUUX.*ULDT.*XC.*UVAL.*PSETIB FSETIB STEFT.*K.*K.*K. UCALL GFUN(1.C.SAVE2.14PDE.*NCPTS.*A.*HC.*DUDU.*UBUUX.*ULDT.*XC.*UVAL.*PSETIB FSETIB CALL GFUN(1.C.SAVE2.11PW.*Z) CONTINUE CONTINUE CONTINUE CONTINUE CALL EVAL(1.0.NCPTS.*A.*HC.*D.*UVAL(1.3), DEBASSIH) *SGRT(1)/FLUAT(NO)) *1.*UV + 0.3*URUUNU DEBASSIH) *SGRT(1)/FLUAT(NO)) *1.*UVAL(1.2), *UVAL(1.3), CALL EVAL(1.0.NCPTS.*A.*NCPE.*C) UFUU.0FUUX.*INFUNE.*CMAX.*SAVE2) *** CALL DIFF (T.*XC(1).*1.*UVAL.*A.*AVE2) *** CALL DIFF (T.*XC(1).*1.*VVAL.*A.*AVE2) *** CALL DIFF (T.*XC(1).*1.*VVAL.*A. | COMMON /GEARI/ T+H+UUMMY(3) + UHOU-4D+N+IDUMMY(3) CUMMON/GEAR9/EPSJ-R0+ML+MU+MV+N*I+NOML+NOW+NOMI DJ 10 I=1+NOd PSETIH PSETIH DJ 10 I=1+NOd PSETIH DJ 10 I=1+NOD DJ 10 I | COMMON /SIZES/ NIMI+KURD+NCC+NPD+NCPIS+NEUN+IUUAD | PSETIB | * |
| COMMON/GEAR9/EPSJ.*RO.*ML.*NU.*NU.*NU.*NU.*NU.*NU.*NU.*NU.*NU.*NU | COMMON/GEAR9/EPSJ.***CoML.**NUM.**NUML.**NUM.**N | COMMON /GFARI/ T.H.DUMMY(3) .UKOULD.N.IDUMMY(3) | PSETIR | 35 |
| DO 10 18-1.00 | DO 10 181.NOW DE 10.0 DE 10. | CHONANGE AND A COST OF A C | DCCTIN | 2 |
| DU 10 1=1.NO4 DE (1)=0.0 DE | DU 10 1=1.NO4 PW(1)=0.0 PW(1)=0.0 PW(1)=0.0 D=0.0 D=0.0 D=0.0 D=0.0 D=0.0 INFORMATION STATE D=0.0 | COMMON/CE AXV/ETVO-XX-+IL-MO-XII-MO-XII-MO-XII-MO-XII-MO-XII-MO-XII-MO-XII-MO-XII-MO-XII-MO-XII-MO-XII-MO-XII-MO-XIII-MO-XII-MO-XIII-MO-XII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO-XIIII-MO | 136110 | s i |
| Pa(1)=0.0 Da(1)=0.0 Da(1 | PSETTH D=0.0 | DO 161 600 | PSETIB | 37 |
| D=1.0 10 K=1.NPDE 10 100 K=1.NPDE 10 10 10 K=1.NPDE 10 10 10 NPDE 10 10 10 NPDE 10 10 10 NPDE 10 10 10 NPDE 10 N | D=1.0 | | PSF TIH | æ. |
| U 100 K = 1.NPDE | U 100 K = 1.NPDE | | DCCTIL | |
| UO 100 K=1.0MDE | UO IOO K=1 NPDE | 0.00 | 01-16-6 | . |
| ISTE(K-1)**NCPTS*1 IEND=K**NCPTS*1 IEND=K**NCPTS* CALL GFUNCT**C**SAVE2************************************ | ST=(K-1)*NCPTS+1 | UO 100 K=1•MPDE | 72E 118 | • |
| IEMDER OF TS CALL GFUNTI.C.SAVE2. HPUE.NCPTS.A.HC.DBUU.UBUUX.DLDT.XC.UVAL. LLEFT.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K | IEMD=K=NCPIS CALL GFUNIT.C.SAVE2.14DE.NCPIS.44.9C.0BUU.vBUUX.vDIT.XC.UVAL. ILEFT.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K.K | [ST=(K-1)*NCPTS+1 | PSETIH | 4 |
| CALL GFUNIT.C.SAVE2.14DE.NCPTS.A.HC.DBUU.UBUUX.ULDT.XC.UVAL. * ILEFT.K.K.K.K.) * ILEFT.K.K.K.K.) * O 20 1=1ST.1END * D-SAVE2(1)***2 * CONTINUE * CONTINUE * CONTINUE * CONTINUE * CALL EVAL(1.NPUE.C. UVAL.A. 1.LP. 1) * CALL DIFF(T.X.C. 1) * 1.0VAL.(1.3) | CALL GFUNIT.C.SAVE2.14DE.NCPTS.A.HC.DBUU.UBUUX.UZDT.XC.UVAL. • ILEFT.K.K.K.K. • ILEFT.K.K.K. • ILEFT.K. | | PSETIN | 42 |
| - ILEFT*K*K*N) - ILEFT*K*K*N) - UC 20 I=1ST*IEND - UC 20 I=1NCPTS - UC 20 I=1 | - ILEFT*K.K.K.) ** ILEFT*K.K.K.) ** UC 20 I=1ST*IEND ** UD 20 I=1ST*IEND ** UD 20 I=1ST*IEND ** CONTINUE ** CONTINUE ** CONTINUE ** CONTINUE ** CALL EVAL(1)*F(LUAT(NO))*I*U+03*URUUNU ** CALL EVAL(1)*NUE*C*UVAL*A*ILE*I) ** CALL EVAL(1)*NUE*C*UVAL*A*ILE*I) ** CALL DIFF(T.XC(1)*I*UVAL*UVAL(1,2)*, UVAL(1,3)*, ** UFUU*DFUUX*INFUUX*NPTE*C*MAX*SAVE*I ** UFUU*DFUUX*INFUUX*NPTE*C*MAX*SAVE*I ** CALL DIFF(T.XC(1)*I*UVAL*NPTE*C*MAX*SAVE*I ** UFUU*DFUUX*INFUUX*NPTE*C*MAX*SAVE*I ** CALL DIFF(T.XC(1)*I*UX*NPTE*C*MAX*SAVE*I ** CALL DIFF(T.XC(1)*I*UX*NT*I ** CALL DIFF(T.XC | TALL CREMENT CONTRACTOR SAND SANDERS SANDERS SANDERS SANDERS SANDERS | DCE T I I | 4 |
| | | | 214100 |) ; |
| U0 Z0 1=15101ENU U0 Z0 1=15101ENU U=D-SAVEZ(1)**2 U=D-SAVEZ(1)**2 UD-SAVEZ(1)**2 UD-SAVEZ(1)**2 UD-SAVEZ(1)**2 UD-SETTH VO=ABS(M)*SORT(U)/F(LUAT(NO))**1**0+03**0/RUUNU U0 30 1=1**NCPTS U2 = (1-1)**CORUD**3 CALL EVAL(1:NPUE *C.*UVAL**0**1LEF!) CALL EVAL(1:NPUE *C.*UVAL**0**1LEF!) CALL EVAL(1:NPUE *C.*UVAL**0**1LEF!) UFUU**0/FUUX**NPTE**CMAX**SAVEZ) ***COLL = ILEFT(1) - 1 ***1UAN***OFTH ***COLL = ILEFT(1) - 1 * | DO 20 I=157+1END DD-SAVEZ(1)**2 DD-SAVEZ(1)**2 DD-SAVEZ(1)**2 DD-SAVEZ(1)**2 DD-SAVEZ(1)**2 DD-SAVEZ(1)**2 DD-SAVEZ(1)**2 DD-SAVEZ(1)**3 DD-SAVEZ(1)**3 DD-SAVEZ(1)**3 DD-SAVEZ(1)**3 DD-SAVEZ(1)**3 DD-SAVEZ(1)**3 DF-TIH PSETIH RLOW = MAXO(1)**4-*4*2 DF-TIH RLOW = MAXO(1)**4-*4 | : | 776.10 | , |
| D=D-SAVE2(1)**2 CONTINUE (CONTINUE (CONTI | D=D+SAVE2(1) **2 CONTINUE K0=ABS(H) *SQRT(1)/FLUAT(NO)) *1.0+03*********************************** | 3 | 136110 | t T |
| CONTINUE (CARSIM) = SQRT(L)/F[LUAT(NO)) *1.0t +0.3*URUUNU (CARSIM) = SQRT(L)/F[LUAT(NO)) *1.0t +0.3*URUUNU (CALL EVAL(I.NPUE.C.*UVAL.A.*ILEF!) (CALL EVAL(I.NPUE.C.*UVAL.A.*ILEF!) (CALL DIFF(T.XC(I).1.1*UVAL(I.2)) **UVAL(I.3)) ** (CALL EVAL(I.NPUE.C.*UVAL.A.*ILEF!) (CALL DIFF(T.XC(I).1.1*UVAL(I.2)) ** (CALL DIFF(T.XC(I).1.1*UVAL(I | CONTINUE (CARSIM) #SORT(1)/F[UAT(100)] #1.0F.03@URUUNU (CARSIM) #SORT(1)/F[UAT(100)] #1.0F.03@URUUNU (CALL EVAL(1.0MPUE.*C.*UVAL.*A.*ILEF!) (CALL DIFF(T.*C(1).*1.*UVAL.*A.*ILEF!) (CALL DIFF(T.*C(1).*1.*UVAL.*A.*SAVE.*) (CALL DIFF(T.*C(1).*1.*UVAL.*A.*SAVE.*) (CALL DIFF(T.*C(1).*1.*UVAL.*A.*SAVE.*) (CALL DIFF(T.*C(1).*1.*UVAL.*A.*SAVE.*) (CALL DIFF(T.*C(1).*1.*UVAL.*A.*SAVE.*) (CALL DIFF(T.*C(1).*I.*UVAL.*A.*SAVE.*) (CALL DIFF(T.*C(1).*I.*UVAL.*A.*A.*SAVE.*) (CALL DIFF(T.*C(1).*I.*UVAL.*A.*A.*SAVE.*) (CALL DIFF(T.*C(1).*I.*UVAL.*A.*A.*SAVE.*) (CALL DIFF(T.*C(1).*I.*UVAL.*A.*A.*SAVE.*) (CALL DIFF(T.*C(1).*I.*UVAL.*A.*A.*SAVE.*) (CALL DIFF(T.*C(1).*I.*UVAL.*A.*A.*A.*SAVE.*) (CALL DIFF(T.*C(1).*I.*UVAL.*A.*A.*A.*A.*A.*A.*A.*A.*A.*A.*A.*A.*A. | | PSE T13 | \$ |
| ### ### ############################## | ### ################################## | _ | PSF TIE | 74 |
| DO 30 | DO 30 [=]*NCPTS CALL EVAL(I*NPUE*C***UVAL***A***ILEF!) CALL DIFF(I*NPUE*C***UVAL**A**ILEF!) CALL DIFF(I*NPUE*C***UVAL**A***ILEF!) * UFUU**DFUUX**UFUUX**NPIE**CMAX*\$AVEZ! * UFUU**DFUUX**UFUUX**NPIE**CMAX*\$AVEZ! * UFUU**DFUUX**UFUUX**NPIE**CMAX*\$AVEZ! * UFUU**DFUUX**UFUUX**NPIE**CMAX*\$AVEZ! * UFUU**DFUUX**UFUUX**NPIE**CMAX*\$AVEZ! * NEUP***MAX***CMAX**SAVEZ! * NEUP***MAX***CMAX**SAVEZ! * NEUP***MAX***CMAX**SAVEZ! * NEUP***MAX***CMAX***CMAX**SAVEZ! * NEUP***MAX***CMAX**SAVEZ! * NEUP***MAX***CMAX***CMAX**SAVEZ! * NEUP***MAX***CMAX**SAVEZ! * NEUP***MAX**CMAX**SAVEZ! * NEUP***MAX**CMAX**CMAX**SAVEZ! * NEUP***MAX**CMAX* | | DCt 711 | đ |
| 10 30 1=1.NCPTS | 10 30 | | | 5 (|
| | | | 7.7. T. | 7 |
| CALL EVAL(I-NPUE.CUVAL-A-ILEF I) CALL DIFFF(T-XC(I)-1-UVAL-(I-2)-UVAL(I-3)- UFUU-DFDUX-UFUUX-NPUE-CMAX-SAVEZ- ICOL = ILEFT(I) - I IUUAU - I PSETIH KLOW = MAX 0(1)-E-C-ICPTS- KUP = MINU(KUMU)-KUMU)-I-2- PSETIH KUP = MINU(KUMU)-KUMU)-I-2- PSETIH PSETIH PSETIH PSETIH PSETIH PSETIH | CALL EVAL(I-NPUE .CUVAL. A ILEF I) CALL DIFFE(T. XC(I) . I UVAL(I | 12 x (1-1) excesses | PS+ 11# | 5 |
| CALL DIFFE(T.XC(1).1.0VAL(1.2).0VAL(1.3). CALL DIFFE(T.XC(1).1.0VAL.0VAL(1.2).0VAL(1.3). DFDU.0FDU.X.NF(10.XX.NR)(0.CMAx.5AV£2) ICOL = ILEFT(1) ~ 1 + IuuAu ~ 1 KLOW = MAXO(1.F.e-iuCPTS) KUP = MINU(KOMI).Rum(1.F.e-iuCPTS) PSETTH PSETTH PSETTH PSETTH PSETTH PSETTH | CALL DIFFITION CONTROL (1-3) C | and the second of the second o | Dection | ij |
| CALL DIFF (TAXC(I) -1:0VAL-(VAL-(1-2) - VAL (1-3) - VSC II U UF UU-OFDUX-1/F (VAX-SAVE2) - VSC II U FOLL = ILEFT(I) - I - IUUAD - I - VSC II H KLOW = MAXO(I) - F-C-1/CPTS) - VSC II H FOLL = | CALL DIFF (1-XC(1)-1:0VAL-10-2)-0VAL(1:3)- UFUU-OFUUX-1/FIUX*NPDE-CMAx-5AVE-2) ICOU = ILEFT(1) ~ 1 - IUUAU ~ 1 KLOW = MAXU(1-F-c-1/CPTS) KUP = MINU(KOM)-NV/M()-1-2) HO 30 K=1-NPDF PSETTH PSETTH PSETTH PSETTH PSETTH PSETTH PSETTH PSETTH | | | - (|
| UFDU&DFUUX*NPTE*CMAx.\$AVE2) ICOL = ILEFT(1) - 1 + IUUA!) - 1 KLOW = MAXU(1*F*c=!uCPTS) KUP = MINU(KOM!)*NUM!)*[-?) FUT = MINU(KOM!)*NUM!)*[-?) FUT = MINU(KOM!)*NUM!)*[-?) | UF DU * DF DU * DF IU * DF T PSFT | CALL DIFFF (I+XC(I)+1+UVAL(I+2)+UVAL(I+3)+ | 72E 18 | 2 |
| COL = ILEFT(1) - 1 + IUUAD - 1 LOW = MAXO(1+6-c-ICPTS) UP = MINO(KOMD-KURID+1-2) PSETIH PS | COL = ILEFT(1) - 1 + IUUA!) - 1 LOW = MAXO(10-6-c-4CPTS) UP = MIND(KOM!) **CACD**[-2) 30 K=1.*Pipf FSETIH FSETIH FSETIH FSETIH | * DFUG-OFUUX-UFFUUX-NPDE-CMAX-SAVE-Z) | PSE TIK | £. |
| | LOW = MAXO(I)*F*c=!CPTS) UP = MINO(KOM)*NUK[)*I=?) 30 K=1*NPUF =(K-1)*NOM)*NUK[)*I=? | | 74 T I K | . |
| | | | | , |
| UD = MINO (KOK) • KUKD• [-7] PSETIK PSETIK PSETIK | UP = MINO(KOM).*\UKU\-?) 30 K=1.\\P\UKU\\U | COLUMN TO PROPERTY OF THE PROP | 170 | n . |
| 30 Kell-NPDF | 30 K#1.*PDF PSETIF | KUP = MINU(KOM).A(J41-2) | PSETIN | ķ |
| | =(K+1)+N0#1+1 PSt11H | | PSETIN | 57 |
| | | | 711 | |
| | | | | |

| NENDMENDED NENDMENDD NENDMENDED NENDMENDD | SUBROUTINE P | SETIH | 76/76 OPT= | OPT=1 MOUND=+-*/ 1-ACE | •/ I-ACE | Z + | F TN 4.4.9H | 04/15/80 | 11.10.37 |
|---|--------------|--|-----------------|---------------------------------------|--|--------------|-----------------|---|----------|
| NO 30 KRIKERLUNKUP J1=1CO KRIE J3 = 17 * KRIE J4 = 17 * KRIE J5 = 17 * KRIE J5 = 17 * KRIE J5 = 17 * KRIE J6 = 17 * KRIE J7 = 17 * KRIE J7 = 17 * KRIE J7 = 17 * KRIE J8 | | | ; | | | | | 25.4.2.50 | ğ |
| U. 3. O. | | NENDRE DE LE COMPANION DE LE C | | | | | | 456110 | 7 |
| 12 = 12 + KOHU 14 = 13 = 12 + KOHU 15 = 12 + KOHU 15 = 12 + KOHU 16 = 0FULKIKI **A(12) **DFULKIKI **A(13) **DETIL 16 = 0.0 **LOHATION** TAIL **INCHES **INCHES **DFULKIKI **A(13) **DETIL 17 = 12 + KOHU 18 = 0.0 **LOHATION** TAIL **INCHES **DFULKIKI **A(13) **DETIL 18 = 0.0 **LOHATION** TAIL **INCHES **INCHES **DFULKIKI **A(13) **DETIL 19 = 0.0 **LOHATION** TAIL **INCHES **INCHES **CHASTA **INCHES **DFULKIKI **A(14) **A(| | | RML R = KLUW | 5 | | | | 011361 | 2 . |
| J3 = 12 * KONIN J3 = 12 * KONIN PER (KST-1:(J-1)*NUCFS)=NFUU(K)*A(J2)*UFUUX (K)*A(J3) PSETIB CONTINUE | 2 | | ICOL • KBLK | | | | | 31 1 100 | |
| J. 3 = 12 * KONU J. 4 = 13 + KONU J. 5 = 12 * KONU J. 5 = 12 * KONU J. 6 = 13 + KONU PETTIN ***OFFULAKIKI PALIJ-1 ***OFFULAKIKI PA | | . 5C | = 12 + KHL | | • | | | 176 | 0 |
| ## UNIT PECTIF PE | | ED | 1 55 • EGE | _ | | | | PSE I IH | F.C |
| ## ## ## ## ## ## ## ## ## ## ## ## ## | | ** | 33 + KUR | _ | | | | PSETIB | 40 |
| 9 CONTINUE C COUNTER I IN CHARATION THE FIRST BLUCK POAS FOR THE ROUNDARY COUNTITIONS. PSETIBLE C COUNTER I IN CHARATION THE FIRST BLUCK POAS FOR THE ROUNDARY CURUITIONS. PSETIBLE C COUNTER I IN CHARATION THE FIRST BLUCK POAS FOR THE ROUNDARY COUNTITIONS. PSETIBLE C COUNTER I IN CHARATION THE FIRST BLUCK POAS FOR THE ROUNDARY COUNTITION TO SETIBLE POSETIBLE FOR THE FIRST BLUCK POAS POAT TO SETIBLE FOR THE FIRST BLUCK POAS FOR THE ROUNDARY COUNTINUE C CONTINUE SO CONTINUE SO CONTINUE SO CONTINUE TO CONTIN | | I + LON MA | 1.1.6.11.134 | NCPTS) #DFD | UCK) ** (32) +0FU | JX (K) PA | (673) | PSETIB | 65 |
| 30 CUNTINUE C HOUSEY THE LAST AND THE FIRST BLOCK POAS FOR THE BOUNDARY CUMULITONS. PSETIB C HOUSEY THE LAST AND THE FIRST BLOCK POAS FOR THE BOUNDARY CUMULITONS. PSETIB C THE ARMAYS DROUGH DROUM AS A RESULT of A PREVIOUS CALL TO GFUN. C THE ARMAYS DROUGH DROUM AS A RESULT of A PREVIOUS CALL TO GFUN. DU 50 KR3 NAUD IN STRICK-13 NAUD 1. TO 50 KR3 NAUD TO 60 JR3 NAUD TO 60 | | | | | | • | | DC6 T 18 | 4 |
| CONTINUE COUNTINUE COUNTINUE CONTINUE CONT | ĉ | | AT LANA AND T | | | | | | |
| C CHARLET THE LIST AND THE FIRST HILDEN FOW THE BOUNDARY COMPITTION IS ALEGADY IN PSETTIB C CHARLEM TIPE OBMATION FOR THE RIGHT BOUNDARY COMPITTION IS ALEGADY IN PSETTIB C CHARLEM TIPE OBMATION FOR THE RIGHT BOUNDARY COMPITTION IS ALEGADY IN PSETTIB C CHARLEM TIPE OBMATION FOR THE RIGHT BOUNDARY COMPITION IS ALEGADY IN PSETTIB C CHARLEM TO SO SO AND ADDUCKEN LEVAL TO GEN. C CONTINUE C CALL EVAL I : MODE .C. C. | | 30 CONTINU | | | | | | 125 | 6 |
| C CHARLY THE LAST AND THE FIRST HILDONARY COMUNITON IS ALREADY IN PSETION C CHARLY THE LAST AND THE FIRST HILDONARY COMUNITON IS ALREADY IN PSETION C THE ARMAYS DROUGH DROUGH AS A RESULT OF A PREVIOUS CALL TO GFUN. DU 50 KT1.MPUE TO 0.0.4 MPU. DROUGH IN SOUTH SETION PSETION IF (DROUGH IN ECO. 0.4 MPU. DROUGH IN SOUTH SETION SETIO | | ,) | ***** | | | | | ! | E S |
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| CALL EVAL(1)**POE.6C**UVAL(1)*2)**DBDUX**UZUT**NPDE) CALL MUNDY(7, AC(1)**UVAL(1)*2)**DBDUX**UZUT**NPDE) DO 70 K=1.*NPDE NST=(K-1)**NOW1**1 IF (DRDUG(K), EG.*0.0ANU.DBDUX(K) *E'4.0.0) GU TO 70 PSETTH DO 60 J=1.*NB PO 00 J=1.*NB CONTINUE CONTINUE CONTINUE CONTINUE CALU DECOMPOSITION UN P**. COLU D | | _ | 20.6 | | | | | PSETIH | 9 |
| CALL (NOBY (T.XC(1)) * UVAL * UVAL (1) * 2) * OBDU* UBDUX * UZUT * NPDE) NET * (K-1) * NVOUN * 1 NEMDAK**NOW! IF (DEDUK). EO. 0.0. * ANU. DBDUX (K) * E'4. 0.0) GO TO 70 BYSETIB NO * OO * 13 * * NW CONTINUE * OO * | 3 | | AL CLIMBOF .C | SOUVAL .A. TL | EFT | | | PSETIB | 8 |
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| C ADD MATRIX A(C.T) TO PW. C ADD MATRIX A(C.T) TO PW. C ADD 90 K=1.NPUE NST=(K-1)*NOW1*! NEND=K*NOW1 IST=(K-1)*NCPTS*! CALL ADDA(PW(NST)*NLPTS*A*ILEFT**C*NPUE**K) C DU LU DECOMPOSITION UN P**. C CALL UECH (NCPTS**NL**MU***MU*****ILEFT************************************ | | 80 PW(1)=P | W(1) *CON | | | | | PSE 11H | 92 |
| C AUD MATRIX A (C.T) TO PW. C AUD MATRIX A (C.T) TO PW. DO 90 K=1.NPUE NST IK -1) **NOW1 **I NST IK -1) **NOW1 **I I STR (K -1) **NOW1 **I C ALL ADDA (PW (NST) **NLPTS **A **ILEF T ***C **NPUE **K) C OU LU DECOMPOSITION UN PW. PSE TIH PS | | (| | | | | | PSE 11B | 56 |
| DU 90 K=1.NPUE NSTR(K=1)*NOW1*1 NSTR(K=1)*NOW1*1 NSTR(K=1)*NOW1*1 SETTH SETTH SETTH CALL ADDA (PW(NST)*NCPTS*A*ILEFT**C*NPUE**R) C DU LU DECOMPOSITION UN P**. CALL UECH (NCPTS*NCPTS*ML**MU*P#(NST)**IF*) **CALL UECH (NCPTS*NCPTS**ML**MU*P#(NST)**IF*) **SETTH PSETTH | | C AIN MATERY | | | | | | PSETIH | *6 |
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| ISTRIK-1) **NCPTS*1 CALL ADDA (PW(NST) **NLPTS*A*ILEFT***C*NPUL**K) COULU DECOMPOSITION UN P**. CALL UECH (NCPTS**NCPTS**ML**MU******************************* | | NE ND BK 61 | [A07] | | | | | PSETIH | 86 |
| Call Adda (PW(NST) • NLPTS•A• LEF •••C•NPUE•K) Could Decomposition un P** Could Decomposition un P** Call Uech (NCPTS•NCPTS•ML•MU•P# (+ST) • [P] v (ST) •] EK) PSETIH Call Uech (NCPTS•NCPTS•ML•MU•P# (+ST) • [P] v (ST) •] EK) PSETIH PSETIH PSETIH PSETIH | | ST= K- | 1) *MCDTC+1 | | | | | PSETIH | 65 |
| C DU LU DECOMPOSITION UN P CALL UECH (NCPTS-NCPTS-ML-MU+PM(FIST) - IPIV(1ST) - 1EK) PSETIH | | | TA COM CINCTLY | NCVTS.A.1 | FF Tor.C.NPUF of | | | PSETIH | 100 |
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| 109 EL(19) 109 EL(19) EL(19) EL(19) EL(19) EL(19) EL(19) | | 1 2000 | |
| 109 ELC3 | | | n . |
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| FT (4) * | | - 15 00 | = |
| | | CUSET | 112 |
| | | 1375 | |
| | | | |
| 1 | | T Jack | 711 |

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| SUMROUTINE COS | COSET | 76/76 OPT=1 MOUND=+-4/ 14ACE | FIN 4.8.4.9B | 04/17/80 | 11.10.37 |
|----------------|-------|---|--------------|---|--|
| 51 | | <pre>L(8) = 1.934523809>238E-03 L(9) = 1.116071428574E-04 L(10) = 2.7557319223980E-06 GU TO 900</pre> | | COSET COSET COSET COSET | 111 111 119 |
| 120 | 110 | EL(1) = 2.8697544642857E-01 EL(3) = 1.4144841269841E-00 EL(4) = 1.0772156084656E-00 EL(5) = 4.9856701940035E-01 EL(6) = 0.1484375E-00 | | COSET COSET COSET COSET COSET | 120 122 123 124 |
| 521 | | EL(7) = 2.9060570987054E-02 EL(8) = 3.7202380952381E-03 EL(9) = 2.9968544656085E-04 EL(10)= 1.3778659611993E-05 EL(11)= 2.7557319223986E-07 | | COSET COSET COSET COSET | 126 127 129 |
| 130 | 111 | GU TO 900 EL(1) = 2.401A959644.394E-01 EL(3) = 1.4644B41269841E-00 EL(4) = 1.1715145502646E-00 EL(5) = 5.7935B1900.3527E-01 | | COSET | 132 |
| 135 | | EL(6) = 1.8832286155201E-01 EL(7) = 4.180362565421E-02 EL(9) = 6.2111441798942E-03 EL(9) = 6.2520667989418E-04 EL(10) = 4.0617401528513E-05 | | COSET COSET COSET COSET | 1966 1966 1966 1966 1966 |
| 140 | 112 | EL(11)= 1.515652573192E-06 EL(12)= 2.5052108385442E-08 EL(1)= 2.742655403160E-01 EL(3)= 1.5099386724361E-00 | | C0SET C0SET C0SET C0SET | |
| 145 | | EL(4) = 1.500271 | | C0SET C0SET C0SET | n & P. & O. O. C. T. |
| 150 | | EL(9) * 1.1192749669312E-03 EL(10) * 9.0939153434153E-05 EL(11) * 4.8225304641475E-06 EL(12) * 1.5031265031∠65E-07 EL(13) * 2.0876756987868E-09 | | COSET | 152 153 153 154 |
| 551 | _ | GO TO 900 EL (1) = 1.0E-00 GO TO = 6.6666666666666666666666666666666666 | | COSET COST COSET COST COSET COST COSET COST COST COST COST COST COST COST COS | 158 158 159 159 |
| 160 165 | 203 | | | COSET COSET COSET COSET COSET COSET | 15.4 & |
| 0.48 | 502 | 0 H H H | | COSE 1 COSE 1 COSE 1 COSE 1 | 641 641 641 641 641 641 641 641 641 641 |

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| NORRON | UBROUTINE COSE | 76/76 OP1=1 MOUNU=+-+/ 1+ACE | FIX 4.84.01 | 04/15/80 | 04/15/80 11:10.37 | PACE |
|--------|----------------|-----------------------------------|-------------|----------|-------------------|------|
| | | EL (5) = 5.474452547445E-02 | | COSET | 173 | |
| | | | | COSET | 174 | |
| | | | | CUSET | 175 | |
| 7. | 705 | 1/0 910 K = 1+3 | | CUSE 1 | 176 | |
| | | TOIK) = PERTSTING.METH.K) | | CUSET | 177 | |
| | | Tule) = .5f-00*10(2)/ FLUAT(NU+/) | | COSET | 178 | |
| | | HE TURN | | C0SE 1 | 179 | |
| | | | | 1900 | 200 | |

CARD 4R. SEVEHITY DETAILS DIAGNOSIS OF PHOHLEM

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AN IF STATEMENT MAY HE MOME EFFICIENT THAN A 2 OR 3 HRANCH CHMPUTED GO TO STATEMENT.

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| | SUMMOUTINE DECH | DECH | 76/76 OPT=1 KOUND=+**/ IMACE | F IN 4.8+452 | 04/15/40 | 11.10.37 | b A Cot | |
|-----|-----------------|----------------|--------------------------------------|--------------|--------------|----------------|---------|--|
| | | | # # | | DECA | 66 | | |
| | | | X # A85(8([+])) | | DECH | 20 | | |
| 4 | _ | 04 | CONTINUE | | UECH | 61 | | |
| É | | 3 | THE CANDAID | | £590 | 29 | | |
| | | ; | • | | UECH | 63 | | |
| | | | | | DECH | 49 | | |
| | | | X H BCARell | | 6 EC | 45 | | |
| 3 | | | B(NR.I) # E(NX.I) | | 65 | şę | | |
| • | | 50 | BINK H XX | | DECH | 29 | | |
| | | 9 | XX # EXCEPT | | UECH | 5 8 | | |
| | | , | _ | | ec. | 69 | | |
| | | | 1) = 1./XM | | cr. | 20 | | |
| 7.0 | | | 1F (MF.O. 61 GO 10 90 | | DECH | 71 | | |
| | | | XX # 45 (25 c) | | £33 | 2 | | |
| | | | KK B BEND (N-NK - LL - 1) | | DECH | 73 | | |
| | | | DO 40 I a NP-LK | | DEC# | 2 | | |
| | | | W - I + 11 # 7 | | DECH | 75 | | |
| 2 | | | XX = G(I-1) 0XH | | DECH | 2 | | |
| : | | | XX a C SXX X | | DECE | 71 | | |
| | | | Do 70 11 = 1.4K | | 8230 | 7. | | |
| | | 20 | H(1-11) = H(1-11-1) + XX+: (NR-11-1) | | UECH | 70 | | |
| | | ı | X (10) # 0° | | DECH | 9 | | |
| 8 | | 9 | CONTINE | | £3 | | | |
| ŕ | | 3 | | | SEC: | 32 | | |
| | | ! | F (R(Ne)) .FO. 0.) 50 TO 100 | | DECH | 83 | | |
| | | • 50 | # 1-/B(N+1) | | £030 | ž | | |
| | | 3 | . 2 | | DECH | 95 | | |
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| • | | . . | TUREN | | OECH OECH | 10 | | |
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PLFLSC.CY=>.
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  L0610 - FLS MEMUIRED TO LOAD - 0015343 00.C06
L0603 - EXECUTION INITIATED 05.EXP
FORTRAN LIMMART 498 01/03/H0
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   111100H MOHDS
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    UN MUNIS
                                                                                                                                                            -ATTACH.TAPE11.INHZNIAIW30.11=5MLJMM.
-ATTACH.TACH.D FKOM SN=SYSTEM
-ATTACH.RTSC.8MZUCKTW30NZL.1DFSMLJMM.
-F54 - CYCLE 1 ATTACH.D FKOM SW=SYSTEM
                                                                                                                                                                                                                                                                          -ATTACH.COLD.HFLSC.1D=SHLJMM.
PF.254 - CYCLE 5 ATTACMED FROM SURSYSTEM
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      34.406 CP SECONDS EXECUTION TIME.
-CATALOG.TAPLZ.MCSOATMW30CN+1C.1D=SMLJMH.
PFO60 - CYCLE 3 CATALOGGO UN SGESYSTEM
-CATALOGGO PERCENDAMANOCN+1ZOUT-110#SSELJMH.
PFO60 - CYCLF 3 CATALOGGO UN SGESYSTEM
JMIS6 - MAXIMUM USER SCH
JMI67 - MAXIMUM USER LCH
ON WG
                                                                                       03/17/80
FLAM
40106
                                  STS IN VICES BIW/ 4/FF FLS=377K FLL=1750K MXS=300K MXL=1305K MXH=1305H
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                                                                                                          CUFF EE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       MAXIMUM JS+10 LCM
MAXIMUM ACTIVE FILTS
07/51/40
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                                                                                HHL NDS/HE 1.3 L499 VEH UU4
-TEMPY-SIMFZ-12UU+P1. CUF!
-ACCOUNI-PD***
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   -SLOAD (COLD) PSE 11H)
-SLOAD (COLD) INTE HP)
-SLOAD (COLD) INTE HP)
-SLOAD (COLD) COEH)
-SLOAD (COLD) SOLH)
                                                                                                                                                                                                                                         -REDUEST . TAPE 2 . + PF .
VER DON ***
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            -SLOAD (COLD.EVAL)
-SLOAD (COLD.DIFFUN)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   -SLUAD (COLD+VALUES)
-SLUAD (COLD+COLPNT)
-SLOAD (COLD+BSPLVD)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        -SLOAD (COLD + HSPL VN)
-SLOAD (COLD + INTERV)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 -SLUAD (COLD . IN I TAL )
                                                                                                                                                                                                                                                                                                                                                                                                                                             -SLUAD (COLD.PVECUL)
-SLUAD (COLD.STIF 16)
                                                                                                                                                                                                                                                          -HEDUE ST . TAPE 9 . * FF
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                                                                                                                                                                                                                                                                                            PF 254 - CYCLE
-SLUADICOLD, MAINI
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  -SLOAD (COLD, AUUA)
                                                                                                                                                                                                                                                                                                                                                                                                                           -SLOAD (COLD+BKPT)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   -SLOAD (COLD + GF UN)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                -SLUAD (COLD + MES)
                                                                                                                                                                                                                                                                                                                                                   -SLOAD (COLD of)
                                                                                                                                                                                                                                                                                                                                    -LUAD (RTSC)
                                                                                                                                                -MAP(UFF)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       M170
F#770
F#771
 03/10/80 SCOPE 2-1-5 H R L
                                                                         HH. MH. SS CPU SECOND ORIGIN
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| | KWS | KWS | 3 | MMS | SEC | SEC | 3 | SEC | | |
|------------------|-----------|--------|------|-------|-------|-------|----------|----------------|---------------|----------------|
| CALLS | 1 317.071 | 317.16 | 0.01 | 0.78h | 34.64 | 34.01 | 3) 1.314 | 45.79.3 SEC | 44.44 | SCALC SWAPS |
| HM777 - RECALL C | SCM | HO1 | 1/0 | RMS | USER | , 40C | 010 | 58 | COST ESTIMATE | SC050 - 000015 |
| | | | | | | | | U0034.870 MFZ. | | |
| | | | | | | | | 12.50.21 | | |

H2-AIR FLAME. SU PENCENT H2. WARNATZ KINETICS.

PHESSUME = 1.00006+00 ATM.

NPUE = 3

| 1.0000E+00 6.4851E-14 5.2691E-05 5.210JE+04 1.7000E+01 1.1025E-10 5.2566E-07 5.5829E+02 1.6000E+01 1.0376E-10 1.0468E-07 3.7221E+03 3.2000E+01 2.1401E-10 1.0468E-07 3.7221E+03 3.2000E+01 2.1401E-10 1.3187E-10 -9.5683E-02 2.0000E+02 1.8000E+01 1.1725E-01 1.3.9518E-02 2.9900E+01 The Third The Thir | | | 3 | | 2 | ₹ | ž | RZD |
|--|---|--------|------------|-------------|-------------|------------|--------------|-------------|
| 7000E+01 -1025E-10 5.2566E-0' 5.5829E+02 5000E+01 -0376E-10 -046NE-0' 3.7221E+03 3000E+01 -2040E-10 -0533E-11 -5466E+02 4000E+01 -2040E-10 -3564E-0' -1.5991E-0 2000E+01 -1790E-01 -3495E-0' -1.5991E-0 4000E+01 -1779E-01 -3495E-01 -3.951HE-02 H000E+01 -1775E-01 -1725E-01 -3.951HE-02 H000E+01 -1775E-01 -1725E-01 -3.951HE-02 H000E+01 -1779E-00 -1775E-01 -3.951HE-02 | - | I | 0.7 | 000E+00 | 6.48518-14 | 5.2691E-US | 5.210JE+04 | 4.5434E-07 |
| 6000E * * * * * * * * * * * * * * * * * * | ~ | 3 | 1.7 | 000E+01 | 1.10256-10 | 5.2566£-0> | 5.5829t.+02 | 1.35306-07 |
| 3000E + 01 2-1401E - 10 1-9533E - 11 1-5140E + 02 4000E + 01 2-2044E - 10 1-3187E - 10 -9-5683E + 02 2000E + 01 2-1790E - 02 3-7564E - 07 - 1-5951E - 01 2000E + 01 2-1790E - 01 4-3495E - 04 - 3-5683E - 01 4000E + 01 1-1673E - 08 2-4508E - 01 - 3-5683E - 02 4000E + 01 7-1755E - 01 7-1755E - 01 - 3-9518E - 02 4000E + 01 7-1755E - 01 7-1755E - 01 7-1755E - 01 - 3-9518E - 02 4000E + 01 7-1755E - 01 7-175E - 01 7-17 | m | 0 | 9.1 | 000E +01 | 1.0376E-10 | 1.046HE-U/ | 3.72216+03 | 1.3746E-07 |
| 4000E+01 2-2049E-10 1-3187E-10 -9-5683E+02 0000E+00 6-4851E-02 3-7564E-02 -1-5951E-01 2000E+01 2-1790E-01 4-3495E-02 -3-5689E-02 6000E+01 1-1673E-08 2-4508E-01 -3-5689E-02 8000E+01 7-1755E-01 7-1725E-01 -3-9518E-02 TH = 1-9365E+00 3 press 5-8000E-05 TMN = 1-0000E-03 | • | ₹0H | | 10006 +01 | 2.140 1E-10 | 1.95336-11 | 1.5146E+02 | 9.0984E-08 |
| 0000E+00 6-4651E-02 3.7564E-02 -1.5951E-01 2000E+01 2-1790E-01 4.3695E-04 -3.5689E-02 6000E+01 1.1673E-08 2.4508E-01 -3.2110E+03 6000E+01 7.1725E-01 7.1725E-01 -3.9514E-02 1H = 1.9365E+00 | s | H202 | • | 000E+01 | 2-20496-10 | 1.3187E-10 | -9.5683£+02 | 9.0471E-0h |
| 2000E.01 2.1790E-01 4.3495E-0× -3.5689E-02 6000E.01 1.1673E-08 2.4508E-01 -3.2110E.03 6000E.01 7.1725E-01 -3.9514E-02 7000E.01 7.1725E-01 -3.9514E-02 7000E.03 7000E-03 7000E-03 7000E-03 7000E-03 7000E-03 7000E-03 | c | I | | 000F+00 | 6.4851E-02 | 3.7564E-02 | -1.5951E-Ul | 2.3005E-07 |
| ### ################################## | ~ | 20 | | 10-3000 | 2.1790£-01 | 4.3495E-UM | | 9-42456-08 |
| ###################################### | Œ | H2C | | 1000E+01 | 1.1673E-08 | 2.45085-01 | | 1.1 A38E-07 |
| TH = 1.9365E+00 | • | N. | | 10 00E + 01 | 7.1725E-01 | 7.1725E-01 | -3.95146-02 | 1.3902E-07 |
| 1.0000E+03 FFFN # 5.0000E+05 THN # | | 5 | 2.9800E-01 | 13. | 1.936nE+00 | | | |
| | | Ž N | 1.0000E+03 | Ĭ | н | · | : 1.0000k-03 | |
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CPMX = 4.78564-01 HL = 7.84401-05 IPE-1 = 2.98001-03

PHU = 0.

EPS = 1.00001-03 SHEC = 1.00001-06

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* LUSP # U.

MTMAII = 1 THEINT = 5.000U--UI

THAN = 1.00001.+02

NC1 = 4 + 1 + 4 + 10000€ + 011

9.04%-17 -2.2737E-13 6.40H0E+09 1.8349F+09 1.00006-30 3.0306t-01 3.0364f-01 3.7067t-01 4.2659t-01 5.1473t-01 1.8571t-01 2.3900f-01 3.H.366t -01 2.724 JE -01 1.05596 ċ 2.71056-20 2.3677E-03 H.2698E+01 3.0761E+01 8.04316.00 3.3063E-01 3.3063E-01 3.6634E-01 4.2042E-01 5.0198E-01 3.4901E-01 9.H01HE-02 1.795AE-01 2.3366E-01 2.6437E-01 1.dlv/E-03 1.8094E-03 4.6010E-03 1.8849E-03 2.7720E+01 7.6144E+UU ×.827 4€ +01 3.6<00£-01 4.1429£-01 4.9332£-01 3.24501-01 20-1.7345E-01 2.66.31E-0 2.45.46[-0] 3.2757E-0 4.5766E ÷ ; 2.2737E-13 5.30246+01 A.0253E+00 1.5050E+02 1.4733E-01 2.2500E-01 4.08176-01 4.8465E-01 6.0000E-01 3.0000£ -01 7.35148-02 2.6324F-01 2.9387E-01 3.2450E-01 3.57676-01 • 4.8471E-06 -5.7347E-09 -5.1461E-05 -3.1377E+06 -7.4797E+05 2.2057t-01 2.6018t-01 4.02046-01 4.75996-01 5.87756-01 2.7550t-01 6.12hlt-U2 1.5850t-U1 2.90A1E-01 3.2144E-01 3.5334k-0] 1.5754E-01 : H.4713E-22 2.26/3E.02 -2.61.30E.10 -6.78~4F+09 4.846 11 -02 3.9592t-11 4.6733t-11 5.7550t-11 2.5099E-01 TOTAL STEPS 4.9009E-UZ 1.5000E-11 2.1634t-u1 2.5714t-111 2.8775t-111 3.4401E-11] 3.1H3Ht-1 H • = 2.5095E-01 TO PHI* 3.1661E+06 2.7060E-03 2.7492E-03 # X 01 2.15346-11 3.4595t-01 3.4595t-01 3.8979t-01 4.586t-01 5.6324t-01 3.6757t-UZ 1.41341-01 2.5405£-01 2.8468£-0] 2.1021f.-u] 9.53436-01 ÷ ÷ 2.0AA6E-02 -2.5163F.04 -2.4724E+04 -R.5046E+02 1.6733E-01 6.0000E-01 7.4505E-07 1.3267E-01 2.0408E-01 2.5099E-01 ė 3.1225E-01 3.8366E-01 5.50946-01 VCEN 8-0000E-03 FRONI FROM PHI* 5 ċ H K 3 2.068Ut-25 9.0867k-03 -2.5516t+03 H. 3493E +U? 7.6276£+02 FLAME FRUNT FRUN 5.0198t-n1 5.3874t-01 .225ct -0c .4666 -0 J 2.7856k-01 .2401E-0 .4746t-0 3.0919£-0 4.4134E-0 3-398cr-0 3.793.k-0 ċ TIME ċ W M FLAME SPEED # FLARE XCF Z LEFT LEFT LEFT PLAME SPEEU SPLEU 1.1535E-01 1.91M3F-01 2.4233E-01 2.7550E-01 3.0413E-01 3.3476E-01 4.32675-01 ¥ 5.25496-01 4.37676-0 ۲ 7 4 FLAT Ī

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6. 3065F-04

DENSITY

INITIAL

119

THICKNESS

P. 0431£+00 . FLSP 5.07246-03 n Ç

Ħ S SPEFIN = -1.0145F-UI

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TOTAL STUS 2.7511t-04 H 5 5.00006-03

<u>,</u>

HUN TIME # 5.8600E.00

UPM2 AT LEFI = -1.8652L-07 -5.30941-07 -9.6195E-UR -3.6034E-US -4.9577E-07 1.0648E-U3 7.2452E-U3 -6.4641E-03 -1.8U76F-03 -3.8M44E-02 9.6679E+01 1.1624E+02 6.6176E+02 9.09672-03 2.7060f-03 2.7492f-03 1.819/f-03 1.80942-03 4.6010£-03 1.8849F-03 2.3677E-03 3.82626+01 7.39386+01 2.0476E+02 7.31786+02 5.3483£+04 SPEEU = 1.76344+07 1.88396+02 4.52256+02 2.85486+02 6.6555E+03 1.3411k-U9 -1.7184F-09 HZO AT LEFT # JOH AT LEFT =

TO PHI* # 1.6627E-01 FLAME FRUNT FRUM PMI* = 2.4225t-01

2.6840t-03 1.984ME.03 6.5519f-05 -4.757ct.09 -1.3298E.08 2.0145E.01

4.693ME+02 7.5362E+02

5.9300£+02

FLAME SPEEU *

SPEEU =

PLAME

1.6072E+01 1.4593E+01 -3.0986++02

FLAME FHONI FHUM X = 2.02.67E-02 TU X =

5.2817t-02

3 FLAME THICKNESS # 3.2565E-02 PHNEW = 2.9407E-01 FLSP = 6.0845E+01 = 3.8372E-02 SPEE ... = -7.6744E-01 SPN2 = -1.5648E+UU SPNI = -7.6744t-01

120

US = -6.660UE-01

1)T = 6.3976£-04

1 = 1.0000E-UZ

Š

TOTAL STEPS =

۳ ک ţ

= 6.9270t.00

HUN TIME

UPM2 AT LEFT = -5.5150£-07 -1.8045£-06 -4.8140£-07 -6.2449£-U5 -4.5260£-U6 4.9272F-U3 +4479£-U3 -1.2060E-02 -1.2443£-03 -1.4961£-01 6.0286£-05 3.H157£-06 5.52976.01 -4.19361.02 3. 1471E+01 2.4146F+02 ċ 1.08446.02 1.80946-03 4.6010E-03 1.8849E-03 2.3677E-03 3.1086£-08 -2.6803£-05 -3.7487£-05 9.3H57E+01 5.10436.01 1.5784t +01 2.5450L+U? 3.5339F+O2 4.0492E+O2 3.04/7£+O2 5.01HUE+U2 1.772UF+U2 M. NY 34E + 01 5.93#1E+08 ~2.6625E+08 4.5591E+01 6.7111E+02 5.4544E+03 4.3531E+04 1.743de-111 HZD AT LEFT = 4.0867E-03 2.7060F-03 2.749ZE-03 1.814/E-03 1.38416-07 5.9564E+03 4.2421E+03 1.279UE+00 4.0121E-09 8.8487E-09 5.6945E-09 5.4617L+02 4.8131E+02 UPH AT LEFT # SPEED # FLAME

FLAME FRONT FROM X = 2.00476-02 To X = 3.44420-02

FLAME FHINT FHUM PHIS = 2.37975-01 TO PHIS =

3 FLAME THICKNESS # 3.8379E-02 PHNE = 2.98976-01 115P = 4.5509E + U1 M) = 2.47001-02 05 = 1.4344£-01 SPEE: 41 = -5. 7400E-01 SPN2 = -6.2064E-U] SPAL = -5.7400E-01

1 TOTAL STEPS #

07 = 7.67711E-04

1 = 1. H546E-02

= 3 Ξ 电

NUN 11ME # 9.U430E+00

UPHY AT LEFT = -2.5068E-U6 -1.0467F-05 -7.6319E-U6 -6.1069E-05 -2.6656E-U5 1.1245F-02 1.4853E-02 -3.2268E-02 2.2788E-03 -4.00AME-01 1.74006-04 -2,47206-06 7,14536-03 SPEED = 2.3/172.02 3.136/2.02 3.65/64.02 3.4174/6.02 4.7475/4.02 1.56174.02 1.00116.02 1.07816.02 2.2795/4.02 9.0H39E+01 1.5316E+02 9.4450E+01 -2.4342E+02 9.0867E-03 2.7060E-03 2.7442E-03 1.4147E-03 1.8044E-03 4.6010E-03 1.8849E-03 2.767E-03 1.8149E-0# 6.1181E-08 4.5057E-08 -5.45rcE-07 1.7072E-07 -7.1372E-05 -1.0440E-04 8.H076E+03 1.9964E+06 3.201-E+08 -5.0776E+08 1.2016E+02 7.4871E+01 9.1541E.01 4.50646+02 5.67HIE+02 5.U4/4E+03 2.4456E+U5 1.2997E+02 4.4120t +02 1.4396E +04 HZD AT LEFT * UPH AT LEFF = SPEEU = FLAME SPEEU =

FLAME FRONT FROM X = 1.9410E-02 TO X = 6.53111-02

FLAME FHUNI FHUM PHIN = 2.29254-01 TO PHIN = 3.95904-01

FLAME THILKNESS = 4.5901E-02

PHIRE = 2.983/6-01 11SP = 5,9206F+01 MO = 3.7339£ =02

115 = -1.77/1/6-01 SPEEME = -7.48776-01 00+46881-1- = 2hdS SPN = -1.46172-01

TOTAL STRES # A.0203t.-04 E LO 3-1390£-02

₹

3 <u>[4]</u> 11

MUN TIME = 1.1-296.01

4.0097E-84 1.4274F-84 5.4574F-83 ċ 2. 3677F-03 M2D AT LEFT = 4.60AK72-03 2.70AD-03 2.74AZr-03 1.81/11-03 1.8044-03 4.A0101-03 1.8M490-03 1.3634F-UT 4.8624-UT 3.65.4F-UT -1.655.4F-US 2.44834F-U0 -3.0510F-U4 +6.740M-U4 UPH AT LEFT =

1.5542E-02 4.0314E-02 -6.7902E-02 1.1674t-02 -7.3979E-01 1.3715E+02 1.9403F+02 3.5497E+01 SPKEU = 1.3330k+04 K.2534K+03 M.2743E+05 1.5214E+07 1.1547E+09 1.932HF+02 1.6055F+02 1.5731E+02 1.5960€+02 1.6462E+UZ 1.3393E+02 1.55478+02 5.7429E+05 1.H7H3E+02 B.7nnAE-04 -3.73421-04 2.2109£*02 3.3001€*02 3.0495€*U2 1.93;4€*02 >.6891£*02 4.ch10£+02 UPM2 AT LEFT = -1.0791t-05 -7.3639f-05 -9.4905E-05 5.0901E + 02 3.230HE-02 3.7075F-02 SPEEU = SPEED = +1.416 PLAMF

FLAME FRUNT FRUM X = 1,84926-02 to X = 7.531-1-02

FLAME FHUNT FHUM PHI* = 2.16311-01 TO PHI* = 4.1426E-01

FLAME THICKNESS = 5.6824F-02 CM

MO = 7.70356-02 FLSP = 1.22156.02 PMNER = 2.87026-01

1)5 = -2.4131E+00 SPEELIG # -3-5599E+00 SM2 = -5.5740E+00 SPN = -1.5407E.00

T = 3.4346-02 OT = 8.05276-04 TOTAL SIPPS =

3

NF = 169 NJ = 15

HUN TIME = 1.35918+01

UPH2 AT LEFT = -3.4347L-U5 -3.8602E-U4 -5.0468E-U4 6.1611E-U3 -1.2096E-U3 1.5902E-U7 7.9617E-U2 -1.1364E-01 1.4161E-U7 -1.0406E.On 2.5742E-07 3.0457E-06 3.9378E-06 -6.4761E-05 1.0302E-05 -3.4882E-04 -6.5792E-04 9.3984E-04 1.5412F-04 1.0333E-07 1. AHAHE + 02 9.67461 +00 ÷ 1.58356+02 9.0 H67L-03 2,7060E-03 2,7492E-03 1,8147E-03 1,8094E-03 4,6010E-03 1,8849E-03 2,3677E-03 1.84576+02 1.80236+02 1.56316+02 1.8278E . 02 1.81095.02 FLAME SMELU = 2.21511+UP 2.4369F+02 2.6650E+02 1.0417E+02 4.2863E+02 1.7817E+02 2.06485.02 2.1504E+02 4.8375£+05 1.2131E+UM 4.1628E+02 -1.9614E+03 SPEEU = 7.19488.+03 3.10058.+03 7.57158.+05 -6.66008.+07 2.4441L.02 3.3919E.02 H2D AT LEFT = FLAME SULFIJ = UPH AT LEFT = * LAM

FLAME FRONT FRUP A = 1.8443E-02 TO X = 4.180-1-02

FLAME FRONT FRUM PHIS = 2,1631E-01 TO PHIS = 4,32561-01

FLAME THICKNESS = 6.3344F-02 CM

MO = 1.164UE-U1 +LSP = 1.845M+U/ PHIE = 2.4562E-U1

5012 = -5.4343t.+110

SPN1 2 -2.32411+00

10-1111-11-11

SPEE ... = -3.44126.00

= 4.6021E-02 DT = 6.3384E-04 TUTAL STEPS = 123

190 NJ = 17

HUN TIME = 1.5322E+01

UPH2 AT LEFT = -2.1751k-U5 -6.9877k-U4 -4.4.4JU7E-U4 1.4J27E-U2 -1.U355E-U3 1.3772k-U2 1.U944k-01 -1.J197E-U1 -3.U135E-03 -1.U441E+AA 1.21HYE-06 -1.4871E-04 1.0728E-U5 -2.9A31E-04 -1.0717E-03 1.2402E-U3 2.5444E-04 1.031AE-02 1.79041.02 1.9836E+02 2.0087E+02 -1.9702t+02 2.0007E+UZ 1.978RE+02 3.76R5E+00 1.49676+02 9.0867E-03 2.7060F-03 2.749ZE-03 1.819/E-03 1.8094E-03 4.601UE-03 1.8849E-03 2.367RE-03 1.69635.02 FLAME SPEEU = 2.21241.02 2.68298.02 2.41494.02 1.46146.02 3.12931.02 1.85746.02 2.17276+02 2.33936 +02 2.4318E+07 3.3499E+02 -1.08rrE+03 2.8065F+05 FLAME FHONT FHUM PHI* = 2.24976-01 TU PHI* = 4.5854E-01 FLAME SPEEU = 3,7140E+03 1,5632E+03 6,7018E+04 -6,9575E+06 2.7012t+02 3.1793f+02 1.6379L-07 5.9733F-06 FLAME SPEEU = UPH AT LEFT = HZD AT LEFT =

FLAME FRONT FHUM X # 1.9091E-02 TU X # H.8814L-02

FLAME THICKNESS = 6.9724E-02 CM

FO = 1.31886-01 FLSP = 2.09124-02 PHNEW = 2.92804-01

US = 1.145ht+00 SPttin = -2.7356E+00 SPN2 = -2.8335E+UU SPN1 = -2.63764.00

| = 5.6025f-02 | DT = 1.0479E-03 | TOTAL SIFPS =

02 = LN 905 = .

HUN TIME = 1.7056E+01

UPHY AT LEFT = -1.23H/L-U5 -3.6947f-U4 -5.7417f-U4 | 1.2177t-U7 -1.543/t-U3 9.1537f-U3 1.9139L-U2 -4.2614f-U2 -1.6102f-U2 -6.5492F-01 3.7922E-04 6.0855E-03 FLAME SPEED = 2.35346-02 2.32116-02 2.33256-02 1.99004-02 7.70036-02 1.97496-02 1.90066-02 1.87496-62 1.81146-62 7.5415E-04 K2D AT LEFT = 9.0867L-03 2.7060E-03 2.749CL-03 1.8147E-03 1.8094L-03 4.6010L-03 1.8849E-03 2.3677E-03 4.5704E-UB -1.3637E-U4 1.4/2HE-U5 -2.225UF-U4 -1.9684E-U4 9.16741-0H 2.9204E-06 UPH AT LEFT =

4. 70121 + 02

3.0H33E+02 -4.31/-4+02 1.44435E+05 2.327ZE+02 Z.206KE+02 2.2164E+02

2.96051.02

2. 7364E+02

PLAME SPEEU =

FLAME FHUNT FRUM PHIS = 2.2918F-UI TO PHIS = 4.4329E-UI

FLAME FRONT FROM X = 1.9226E-02 10 X = 4.4404E-02

FLAME THICKNESS = R.USB3E-UZ CH

MHNE" = 2.97246-01 FLSP = 2.2683f+02 MU = 1.4305E-01 10-35-36-01 SPEEDE = -2.4610E+00 SPN2 = -3.34UH+UU SPNI = -2.4610E.00

121 TOTAL SIPPS = U1 = 1.47366-03 1 = 7.1404E-02

HUN TIME = 1.9431E+01

UPH AT LEFT = 1.21036-07 2.85176-06 3.61v9E-06 -1.04.14E-04 2.2467E-05 -1.9507E-04 -3.6975E-04 3.7517E-04 2.6495E-04 4.277AE-03 H20 AT LEFT = 9.0H67E-03 2.7060F-03 2.7492E-03 1.6197E-03 1.6094E-03 4.6010E-03 1.8849E-03 2.3677E-03 0.

UPH? AI LEFI = -1.62951-05 -3.7184F-04 -4.8423E-04 1.0446E-02 -2.4414E-03 6.8793E-03 3.9632E-02 -4.5179E-02 -8.5144F-03 -4.6556E-01 2.0520E+02 SPEEU = 9.300AE+02 5.4921E+02 3.1791E+03 -7.02m2E+05 8.1794E+05 2.9265E+02 2.5248E+02 2.5248E+02 -5.0941E+00 FLAME SPEEU = 2.5372E.02 2.6206E.02 2.4767E.02 1.7370E.02 2.7371E.02 2.1963E.02 2.2302E.02 2.1924E.07 2.4860E+02 20+3606**7 3.0762F.02 3.1457E.02 -1.75nrF.03 1.01HZE.05 2.5447E.02 2.8644E.02 FLAME SPEEU =

FLAME FHUNT FHUM PHI* = 2.2925E-01 TO PHI* = 5.0176E-01

FLAME

FLAME FHONT FHUN X = 1.9137E-02 TO X = 1.0250F-01

FLAME THICKNESS = R.335HE.02 CM

PHNE = 2.92541-01 FLSP = 2.4575E+02 40 = 1.5444E-01

115 = -7.504/18-01 SPEE : = -3.01191 +00 00+10+21-+- = 24d5 SPN1 = -3.0997£ .00

27. TOTAL STORS = 01 = 1.4736r = 03 50-36+010-6 = 1

3 Ę 11

10+441+0+2 = 4:11 NOM

-4.4566E-01 3.48906-03 -4.2580E-03 6.6517E-03 1.6656E-02 -4.3869E-02 -1.5466E-02 2.6359£-04 7.41161.00 ċ 3.95618-04 2.3677E-03 2.5002E+02 2.7380E+02 4.6010E-03 1.8849E-03 4.2387£-05 -1.3166f-04 -3.5909E-04 7.5285E+02 <.6902E+02 <.7084E +02 2,44011+02 211-3568912 3.05571 402 2.7492E-03 1.8197E-03 1.8094E-03 2.8215£.02 3.5688E +05 7.86731.04 FLAME FRONT FROM PHI* = 2.2924E-01 TO PHI* = 1.0191E-01 UPHP AT LEFT = -1.4579t-05 -6.8406F-04 -7.1016t-04 2.1049t-02 1.2113E +03 -3.1134E+06 5.4374E-Ub -2.42113E-U4 1.84HIE+02 -2. 29AME+03 2.6395£+02 3.03306+02 2.7050F-03 4.31635 +02 5.71608-06 2.665HF +02 2.8993£ +02 9.UB67E-03 SPEEU = 5.6637E+02 1. Jun4t -07 2.70936 + 02 2.4627£.02 HZD AT LEFT = SPEED = SPEEU = FLAME FLAME

FLAME FHUNI FRUM X = 1.8953E-02 TO X = 1.02111.-01

FLAME THICKNESS = 8.3159E-02 C4

MO = 1.6643E-Ul FLSP = 2.6390E+U2 PHNEW = 2.9UVIE-Ul

SPN1 = -3.3286E+00 SPN2 = -3.905/E+00 SPEEUL = -3.5172E+00

-5 .29 17E -03

SO

287

TUTAL STEPS =

2.4007E-03

D1 =

1 = 1.11278-01

F = 240 NJ = 28

HUN TIME = 2.3101F.01

AT LEFT = -1.29276-05 -4.9446F-04 -6.2235E-04 1.8559E-02 -5.6652E-03 5.4452E-03 3.5077E-02 -3.3260E-02 -1.8026E-02 -3.3743E-01 2.76716-03 3.0913E-04 2.5142E-04 2.4174E+02 -3.4135F-01 • 2.3477E-03 2.6945E+07 2.75AKE+07 4.6010E-U3 1.8849F-U3 4.7H39F +02 5.9178E-05 -7.5989E-05 -3.5980E-04 <.6943E+02 2.1765E+02 2.624HE+02 2044666.5 2. 75536 +02 1.80946-03 20+45404.2 2.5455£+05 5, 99171.04 FLAME FHONI FHUM PHIM = 2.3360E-UI TO PHIM = 4.0202E-01 1.81971-03 5.30711-06 -2.03rct-04 2+5641E+02 FLAME SPEEU = 3.4624E+02 3.7477E+02 5.4240E+02 -3.9917F+05 2.4796E+02 -2.5416E+02 2.7492E-03 2.4960E+02 H2D AT LEFT = 9.08671-03 2,7060E-03 2.25598+02 9.720AL-UB 4.2032F-06 2.5857F+02 2.4237E+UZ 2.44A7E.02 AT LEFT = SPEEU = SPEED = FLAME FLAME

FLAME FHUNT FHUN X = 1.9196E-02 fv X = 6.45641-42

FLAME THICKERSS = 4.53645-02 CH

MO = 1.7328E-01 FLSP = 2.7476E+02 PHNE# = 7.9406E-01

SPN] = -3.4656£+00 SPNZ = -3.8352£+00 SP

9PEERS = -3.4656E+00

:+110 115 = 1.5157E=01

1 = 1.3407F-01 b1 = 2.4007t-03 TUTAL 51rF5 =

<u>\$</u>

N5 = UN 745 = N

KIN TIME = 2+42H7E+01

UPH2 AT LEFT = -1.1677E-U5 -3.7422E-04 -4.9985E-04 1.1 *43E-U2 -6.5888E-U3 4.612RE-U3 2.7916E-U2 -2.4007E-02 -1.3040E-02 -2.6151E-01 4.1576E-06 -1.3014E-04 0.8511E-05 -5.222ME-05 -2.M284E-04 2.1760E-04 1.715ME-04 2.0347E-03 2.7621E+02 2.7790E+02 2.H322E+02 2.675Ht + 02 2.895UE+UZ 2.8019E+UZ 2.8173E+02 -5.8120E-01 2.1976E+02 2,36776-03 2.7999E+02 2.7492E-03 1.814/E-03 1.8094E-03 4.6010E-03 1.8849F-03 2.7352E+02 2.7833E+02 3.1574F+02 3.U5cJE+U2 -1.U9UnE+05 1.6487E+U5 5.U2H9E+04 2.94346+02 2.67175.02 >. U2U~E+01 FLAME SPEŁU = 3.44794+02 2.18416+02 2.72846+02 2.5003F+02 2.8267E+02 H20 AT LEFT = 9.08672-03 2.7060F-03 3.12316-06 2.8263t+02 3.26336+02 H. 7589E-08 SPEEU = UPH AT LEFT = PLAME SPEED = *LAME

FLAME FHONT FHUM PHI* = 2.3354E-01 TU PHI* = 3.8365E-01

FLAME FHONT FHOM X = 1.9115E-02 TU X # 5.7870. -02

FLAME THICKNESS = 3.8754E-02 CH

MI = 1.7602E-U1 FLSP = 2.7912E+U2 PHIEM = 2.9453E-U1

SPN) = -3.5205k+00 SPN2 = -3.4R51k+00 SPkEin: = -3.7205E+00

115 = -5.49 10£-02

r = 1.6937E-01 01 = 2.4007E-03 TOTAL SIFFS =

413

NF = 321 NJ = 28

RUN TIME = 2.5940E+01

Cu- 10470.1 1.40444 - US -4.39384 - US -7.77494 - U4 2.2819E - U4 1.47314 - U4 HZO AT LEFT = 9.08671-113 2.7050f-03 2.7492f-03 1.8197f-03 1.8094f-113 4.6010F-03 1.8849F-03 2.3677E-03 UPH AT LEFT = 1.0117t-07 3.7514f-06 4.4957t-06 -1.52077-04

UPH2 AT LEFT = -1.3678E-05 -6.4793E-04 -2.3145E-04 - 1.4145E-02 -7.1567E-03 -4.6145E-03 -4.7480E-02 -2.4783E-07 -1.3F10E-07 -7.6570E-01

2.8046E+02 2.8795E+02 2.8334E+02 2.7016E+00 2.80466+02 2.8023E+02 2.7795E+U2 2.8036E+02 <- HO40E +02 5.1520E+04 2.7981E+02 2.9639E+02 2.7920E+02 1.4745E+05 2.8100E+02 FLAME FHONT FHUM PHI* = 2,3358E-01 TO PHI* = 3,9590E-01 LAME SPEEU = 2.97246+02 2.24716+02 2.74516+02 2.59226+02 2. H1564.U2 2.4841E.02 2.8111E.02 -2.842UE.02 2.6262E.02 2.1870E.02 -1.991-E.05 FLAME SPEEU = 2.9299E+02 PLAME SPEEU =

FLAME FRONT FROM X = 1.9145E-02 TU X = 6.27591.-02

FLAME THICKNESS = 4.3614E-02 CM

MO = 1.7690E=01 FLSP = 2.8050E+02 PHNEM = 2.9295E=01

05 = -1.13216-01SPEEUS = -3.6337E+00 SPN2 = -3.7245£+00 SPN1 = -3.5340L+00

T = 2.5039E-01 DT = 7.3361E-03 TOTAL STEPS = 231

346 NJ # 31

HUN TIME = 2.8076E+01

UPM2 AT LEFT = -1.0324E-05 -3.5239E-04 -5.0182E-04 | 1.0 cc0L-02 -7.2342E-U3 4.2275E-U3 2.9310E-02 -2.3551E-02 -1.2709E-02 -2.4592E-01 7.6449E-05 -3.7055E-U5 -2.9985E-U4 2.1739E-04 1.547NE-04 1.9192E-03 2.8070£ .02 PLAME SPEEU # 2.63394-02 2.6157F-02 1.9220E-02 -1.1633E-05 1.0940E-05 2.8005E-02 2.8039E-02 2.8059E-02 -2.1515E-01 ċ 2.7799E+UZ 2.8121E+02 HZD AT LEFT = 9.UBA7E-U3 2.7060E-03 2.7492E-03 1.8197E-03 1.8U94E-U3 4.6010E-03 1.8849E-U3 2.3677E-03 2.8059E-02 2.8037E-02 2.8060E-02 3.0737£-02 2.1350E-02 2.735-E-02 2.6935E-02 2.9288E-02 2.8121E-02 2.8136E-02 2.486IE-02 2.8218E-02 -7.5724E-01 3.7126E-04 FLAME FRUNT FRUM PHI* = 2.37961-01 TO PHI* = 4.14291-01 4.266UE-06 -1.19UnE-04 UPH AT LEFT = 7.70416-0H 2.9957E-06 FLAME SPEED = FLAME SPEEU =

FLAME FHUNI FRUM X = 1.9535E-02 TU X = 6.8654-02

FLAME IMICANESS = 4.4118E-02 CM

MI = 1.7700F=U] PLSP = 2.8067E+U2 PHNE = 2.9595E=U] SPN] = -3.5401E+00 SPN2 = -3.5112E+1.U SPEE: = -3.5401E+UU

US = 9.3642E-02

ACS = 24-16 1014 5-45-45-45 1014 51-345-18 1

3.1410E +01 HUN TIME

-1.71296-01 1.3275E-03 -7.2934E-03 4.7095t -05 2.8270E+02 2.8054E+02 3.2514E-113 1.9885E-02 -1.4329E-02 2.8064E+02 2.8234E+02 2.8070E+02 1.30416-04 2.36775-03 2.8036E+02 1.88495-03 2.17436+02 2.8043E+02 -2.0169E-04 4.3792E-05 -2.H572E-05 2.8177E+02 4.60 10F-03 2.8065£+02 2.4074E+UZ 4.1940E-U3 2.115HE+04 5.7995£+03 2.829 BE + 02 1.80946-03 10 PHI* = 4.1427E-01 3.19016-03 1.5519E+02 -7.104.1E+05 2.74921-03 1.8147E-03 2.8329£+02 -1.0309E+03 2.6654E-06 -3.5304E-05 2.56016.02 -1.8641E-04 -3.1793E-04 2.7500£+02 FLAME FRONT FRUM PHI* = 2.4219E-01 1.5657E-06 2.6031£.+02 2,70608-03 2.34116.02 2.69976+02 -5.737 Ht -06 9.0867t-03 4.3087t-08 3.22134 + 02 2.81204.02 2.8218E+02 SPEEU = SPEEU * Ħ SPEED = Ħ UPHZ AT LEFT LEFT UPH AT LEFT = FLAME FLAME FLATE

6.6927.-02 × FLAME FRONT FRUM X = 1.9R14E-02 TU

Š 4.71 DRE -02 FLAME THICKNESS PHNE = 3.0193E-01 2.8058t+02 FLSP 1.76956-01 ì 1.05 3UE-03 H 08 -3.5390£+00 SPEE -3.5069E+UU SPNZ = -3.5390£.00 SPNI

212 TOTAL STEPS 1.6201E-02 * 5 5.00006-01

3 3 418 Ħ ŧ

3.4065£+01 Ħ RUN 11ME

2.9504E-03 3.9459E-03 3.6495E-03 50-36 +60" 1.29126-03 3.0563E-04 3.41.35E-03 3.10366-03 2.7444E-03 1.15.12E-03 3.7581E-03 3.7581E-03 3.1575E-03 2.7139E-03 1.02436-03 2.0421E-04 9.4224E-UR 4.19725-116 -03 3.21442-113 1.6341E-U4 9.0456k-04 .44446-03 3.7454L 2.5060t-u6 .4361E-114 2.2754t-113 .6837t-13 3.H564E-1.3 3.2742t-113 -2474E-114 6,9152t-04 2,1010t-03 3,5943t-03 3.335HE-U3 1,2034£-06 9,9830£-05 3.8.341E-11 2.4131E-03 5. Y794E-04 1.4283E-03 .4902F.-03 3.4334.-03 2.HK33k-03 .470tf-03 2.920BE-03 3.24276-03

1.44544-07 1 . 354AE -07 3.6-3076-08 -3.925UE-08 -1.7946F-08 -3-7700E-09 -2-1492E-118 -3-7130E-18 6.940#£-09 1.1025E-10

| | 1.0227E-06 | 3.1152E-06 | 7.7174E-0 | 1.5638E | 2.7684t-(15 | 460E-0 | 7.95106-05 | 1.2741t-0 | 1.89965-04 | 2.6512t-04 |
|----|---------------------|-------------|--------------|--------------------------|--------------------------|---------------------------|--------------------------|--------------------|--------------|---------------|
| į | 3.5649E=04 | | 4-43316-0 | ė. | 0.801CE-114 | 7.1215E-04 | • | 7.3353E-0 | 7.2803E-04 | 7.15156-04 |
| | 40-76-76-7 | | A.4077F | 0.5440 5446 | 1.016/E-31 | 1.12615-04 | _ | | 0.75136-04 | 7.04156-06 |
| | 1.49246-03 | , – | 1.5576 | 1.5690E | 1.5652t-1.3 | 1.54412-03 | _ | 1 - 4 / 4 7 t - fi | 1.47656-01 | 1 - 36 36 - 1 |
| | 1.35736-03 | 1.3264E-0 | 304FE | 1.2456 | 1.27336-113 | 1.2556t-03 | | 1 - Proph - 0 | 1.27106-03 | 1.27696-03 |
| | .28336 | 1.24192-0 | 1.2998E-03 | 4.3069t-U | 1.31324-1.3 | 1.31456-03 | | 1.3cb4t-0 | 1 . 328HE-03 | 1.33296-03 |
| | 1,33936-03 | 1.3472£-03 | 1.3557k-03 | | 1.37076-03 | 1.37556-03 | _ | | | |
| | | 0 | | | | | | | | |
| | 01-37550 | 1326 | • | | **** | 1 | | | 1 | |
| | 1.8801E-07 | | 5-33496-08 | -3. /#/0E-08 | 7.0760t-07 | 1.54636-06 | -3.3939F-UR | 3.7.446-06 | 2.2353E-07 | 2.7054t-07 |
| | 6.9344E-06 | | 1.7221E-0 | | | | 7.4.4.NE | 1.00286-04 | 1.31446-04 | 1.48505-04 |
| | 2.1160E-04 | 2.6086t-04 | 3-16405-0 | | | | 4.735RE | ÷ | 5.3919£-04 | 5.6691E-04 |
| | 1 - 1 0 M 0 E - 0 3 | 1.2404E-03 | 1 - 3803F -0 | | | | 1.56764 | ė ė | 8.929#K-64 | 9.9085E-04 |
| | <.0470E-U3 | Z.00611-03 | 1.93794-0 | 1.8442E-U3 | | | | 1.18366-03 | 1.015AE-03 | B. 6192E-04 |
| | 7.2617E-04 | 6.1290E-04 | 5.26436 | 4.36HZt-04 | 3.6849E-114 | | 2.83116 | ė. | 2.4514E-04 | 2.3608£-04 |
| _ | 7896 | 1.7535£-04 | 1.72376-04 | 1.7002E-04 | 1.6932L-04 | 1.9880c-04 1.6729c-04 | 1.9>00E-04 1.6694E-04 | 1.91506-04 | 1.87976-04 | 1.8317E-04 |
| | | ног | | | | | | | | |
| _ | | | | | • | ; | | | | |
| | <-1401E-10 | 1.37156-06 | -9.3423E-08 | 2.1863E-07 5.8951F-06 | | 8.5956k-07 | 9.0807E-07 | | -2.39716-67 | -5.5285£-07 |
| J | 1-14065-04 | | | | 5.8981 | 7.2696t-04 | 8.6568E-04 | | 1.09826-03 | 1.16716-03 |
| 1 | 1.14795-03 | | | | 8.2631k | 7.2900t-04 | 6.3838E-04 | | 4.82456-04 | 4.197HE-04 |
| 29 | 1.29866-04 | 3.2.00E-04 | • | | | 7.515445-54 7.51445-55 | 1.9031E-04 | | 1.5701E-04 | 1.4279E-04 |
|) | •35?5E | 3.7832L-05 | | | 2.379UL | 1.47296-05 | 1.45786-05 | | 8.5898E-06 | 6.5445E-06 |
| | 4.9933£-06 | 3.8321E-06 | | | 1.31724 | 8.3316k-07 | 5.19805-07 | 3.3/ule-07 | 2.4400E-07 | 2.03146-07 |
| | .8660E | 4.67116-08 | 4.5190E-08 | 4.40656-08 | 4.3303E-08 | .2869t | 4.27325-08 | | 3. JYBUE -08 | 5.10/3E-0A |
| _ | A) CH | 2 | | | | | | | | |
| | - | 2.51134-07 | 7.6061E-0A | -3.2H25t-U7 | -7-650bt-"7 | -1.0377t-06 | | | | 1.59116-06 |
| _ | 10-35+10 | -3.09154-07 | -1.4063E-06 | -1.7334E-U6 | -6.401ct-117 | 2.5441t-0h | | | | 9.59965-06 |
| | 7-60875-04 | 8.5282£-04 | 4.5625£-05 | 8.3412E-05 | 1.3945E-04 9.4587E-04 | 2.0 350t -04 | | | | 6.4969E-04 |
| _ | 4 | 6.3088E-04 | 5-51386-04 | 4.6945E-U4 | 3.8789E-14 | 3.03476-04 | | | | 8.11146-05 |
| | 200 | 3.7132E-07 | 4.0754-07 | 4.4 MH 3F -UD | 5.1575E-16 | 3.43/8E-05 | | | | 5.6651E-07 |
| _ | 7692E-07 | 1.67216-07 | 1.5776E-07 | 1.4503E-07 | 1.3601E-07 | 1.3004E-07 | 1.26481-07 | 1.24/06-07 | 1.24056-07 | 1.23896-07 |
| | -0. | 1.16546-07 | | 1.15496-07 | 1.15156-47 | 1.20055-07 | | | | 1. IMORE-07 |
| _ | ¥. | 42 | | | | | | | | |
| J | 6.4451E-02 | | _ | 6.44516 | •4851t-1,2 | 6.4m50t-02 | 6.484F-02 | | 6.4841F-02 | 4.4819Fa02 |
| | 0.4836E-02 | 6.4831£-02 | - | | 2 | 6.4771E-02 | 6.473RE-02 | | | 4.4634E-02 |
| J | 0.2919E-02 | | | 6.14536 | · · | 6.1113E-02 | 6.3853E-02 | | | 6.32136-02 |
| | 2.8661E-02 | | | 5.673lt | | 5.>231k-02 | 5.44146-02 | | | 5-16726-02 |
| , | 0044F-02 | | 4. H518E -02 | 4.741 % -U.Z | ? ? | 4.514CE-02 | 4-4074F-02 | 4.2744E-02 | 4.19596-02 | 4.0473F-02 |
| | 3.421 ME-02 | . | 3-3965E-02 | 3.3070t | . ~ | 3.34036-02 | 3.34176-62 | | 3.39001-02 | 3.3956E-02 |
| | 3.40]]E-0? | | 3-4157E-02 | | 3.42972-12 | 3.4.304E-U.2 | スリーナランカ | | 3.45446-02 | 3.4629102 |
| , | | | 4 A - 4 A | | 3.06 | 34.44.45 | 21.20100*6 | | | |

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| | | | 1. 3176t-03 -1.7063E-01 |
|---|---|--|--|
| 2-1744E-01 2-1740E-01 2-130E-01 1-9183E-01 1-4742E-01 9-3941E-03 3-1044E-04 8-5147E-05 | 8,7742E-06 9,3328E-05 9,3318E-03 3,1047E-02 8,4854E-01 2,3306E-01 2,434E-01 2,434E-01 | 7.1726E-01 7.1739E-01 7.1569E-01 7.1569E-01 7.1370E-01 7.174E-01 7.1735E-01 3.9692E-01 3.9692E-01 6.4748E-01 | |
| 2.1749E-01 2.1741E-01 1.9475E-01 1.5360E-01 7.4976E-02 1.8252E-02 4.9522E-05 | 7.0003E-06 9.1072E-05 3.6047E-03 7.7716E-02 1.6327E-01 2.2991E-01 2.4343E-01 | 7.17266-01 7.1846-01 7.1846-01 7.15246-01 7.1376-01 7.1746-01 7.1746-01 7.1746-01 7.1746-01 7.1746-01 7.1746-01 7.1746-01 | 1.4057E-00 1.4057E-00 1.4057E-00 1.4057E-00 1.4057E-00 1.4057E-03 1.4057E-04 1.4057E-02 |
| 2.1740E-01 2.1741E-01 1.9746E-01 1.9746E-01 1.5445E-01 8.3430E-02 1.5744E-02 | 7.5457E-07 2.6.176E-05 2.6.176E-03 7.305E-02 7.305E-02 1.54.37E-01 2.2542E-01 2.4348E-01 | 7.175E-01 7.174E-01 7.154E-01 7.1540E-01 7.1340E-01 7.14E-01 7.174E-01 7.174E-01 7.174E-01 7.174E-01 7.174E-01 7.174E-01 7.174E-01 7.174E-01 7.174E-01 7.174E-01 7.174E-01 | |
| 2.1740E -01 2.1571E -01 2.1571E -01 1.9496E -01 1.6447E -01 9.2103E -02 8.0481E -02 8.0401E -05 7.5848E -05 | -2.4827E-06 7.7171E-05 1.9902E-03 6.4852E-02 1.4522E-01 2.2096E-01 2.4361E-01 | 7.1725E-01 7.173E-01 7.1556E-01 7.134PE-01 7.134PE-01 7.1740E-01 7.1740E-01 7.1724E-01 7.1724E-01 7.1724E-01 8.66431E-01 | 1.1777 E + 10 1 1.177 E + 10 2 2.177 |
| 2.1740c-01 2.1642bc-01 2.022bc-01 1.6929c-01 1.00Mlc-01 2.611lc-02 7.6037c-05 | -3.4570t-06 3.5919t-05 1.4824t-03 1.7946t-02 5.9024t-02 1.3598t-01 2.1490t-01 2.4217t-01 2.4341t-01 | rrrrrrr anna | <u>ພໍມີຈັນຄື</u> |
| 2.1790c-u1 2.1784c-u1 2.1784c-u1 2.0434c-u1 1.0937c-u1 3.2924c-u2 3.2924c-u2 7.96614c-u3 | -2.8976E-06 1.1086E-05 1.093E-03 1.5536E-02 1.568E-02 2.0761E-01 2.438E-01 2.438E-01 | rrrrrrr anasa | 1.1217E-0 1.3915E-0 1.598BE-0 1.6273 |
| 2.1790E-01 2.1790E-01 2.0621E-01 1.7790E-01 1.170E-01 3.838E-02 2.9583E-03 1.1736E-05 | -1.5378E-06 -6.8427E-07 6.7513E-04 1.2993E-02 4.8458E-02 1.17893E-01 2.0164E-01 2.4027E-01 2.4341E-01 2.4342E-01 | 571.7 571.7 571.7 571.7 141.7 571.7 571.7 571.7 571.7 571.7 571.7 571.7 571.7 | 11.002 11.002 11.002 11.002 12.002 10 |
| 2.1790E-01 2.1740E-01 2.0779E-01 2.0779E-01 1.2574E-01 4.407E-02 4.3012E-03 1.4781E-04 | -1.1076£-07 -3.1459£-06 3.9197£-04 1.0915£-02 4.3674£-02 1.0907£-01 1.9507£-01 2.3376£-01 | | 1.0614E+00 1.0 1.3097E+00 1.0 1.5322E+00 1.0 1.6136E+00 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 |
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| 2.17905-01 2.17896-01 2.1786-01 2.1686-01 1.84656-01 1.44676-01 5.90186-02 7.20246-03 4.65266-05 | 1.1673E-08 5.2380E-06 1.2696E-04 5.4997E-02 3.4997E-02 1.8005E-01 2.3550E-01 2.4356E-01 | 7.1726E-01 | 9.9746E-01 1.2710E-00 1.5710E-00 1.5727E-00 1.5955E-00 |

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GLOSSARY

- $c_{\rm pk}$ = specific heat of species k, cal-g⁻¹ K⁻¹.
- $c_{\rm p}$ = specific heat of the mixture, cal-g⁻¹ K⁻¹.
- D_{km} = diffusion coefficient of species k in the mixture, cm²-s⁻¹.
- h_k = specific enthalpy of species k, cal-g⁻¹.
- k; = rate constant for reaction j in centimeter mole second units.
- m_0 = mass flux of the mixture through the origin, $g-cm^{-2}-s^{-1}$.
- M_k = molecular weight of species k, g-mole⁻¹.
- N = number of chemical species (also number of PDE's).
- NO = number of ODE's.
- p = pressure, atmos.
- $r_i = \text{rate of reaction j, mole-cm}^{-1} \text{s}^{-1}$.
- R = gas constant = 82.05 cm^3 -atoms-mole⁻¹-K⁻¹.
- R_k = rate of production of species k, mole-cm⁻³-s⁻¹.
- S_{v} = velocity of the flame relative to the unburned mixture, cm-s⁻¹.
- \hat{t} = temporal coordinate, s. $(\hat{t}, \hat{x} \text{ coordinate system})$.
- \tilde{t} = temporal coordinate, s. $(\tilde{t}, \tilde{\psi} \text{ coordinate system})$.
- t = non dimensional temporal coordinate, with respect to t_{∞} (t, ψ coordinate system).
- \hat{T} = temperature of the mixture, K.
- \tilde{T} = temperature of the mixture, K.
- T = non dimensional temperature of the mixture, with respect to T_{∞} .
- T_{il} = temperature of the unburned mixture.

GLOSSARY (continued)

- $T_{\rm R}$ = temperature of the burned mixture (adiabatic temperature).
- v = fluid velocity of the mixture, cm-s⁻¹.
- V_k = diffusion velocity of species k, cm-s⁻¹.
- \hat{x} = spatial coordinate, cm.
- Y_{ν} = mass fraction of species k.
- Y_{kij} = mass fraction of species k in the unburned mixture.
- Y_{kR} = mass fraction of species k in the burned mixture.
- ε_{ν} = mass flux fraction of species k.
- λ = heat conductivity of the mixture, cal-cm⁻¹-s⁻¹-K⁻¹.
- ρ = density of the mixture, g-cm⁻³.
- ψ = transformed distance coordinate, g-cm⁻².
- ψ = non dimensional transformed distance coordinate, with respect to $\psi_{\infty}.$

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